THE

CHEMIST.

VOL. I.

"——Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if nought in these external scenes
Can move thy wonder?——"

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APOLOGY AND PREFACE.

The number of Chemists who have distinguished themselves, in times past and present, is now so great, that we have met with unaccountable perplexities in endeavouring to fulfil our promise of selecting the portrait of one as the ornament of our Supplement, and the presiding genius of our work. Chemistry, indeed, is so rich in great men, that it is like the Catholic religion, which has a saint for almost every day in the year; and the Editor of a humble weekly publication has as much difficulty in selecting a patron as a man who balances betwixt the saving faith in a St. Benedict or in a St. Francis. As in religion, however, most men have their opinions fixed by the place of their birth, so in chemistry they seem settled by the same circumstance, and by their education and occupations. In France men swear by Lavoisier, Berthollet, and Gay Lussac; in Germany by Stahl, Richter, and Stromeyer; while in England they appeal to Black, Priestley, and Davy. When we trace the subdivisions of those who cultivate the science, in our own country only, into different sects, we shall also find that for each there is some author or some discoverer who has peculiar claims on its respect and admiration. Those who delight chiefly in bold experiments, successful inventions, enlarged views, and comprehensive theories—who are not very fastidious about neatness of composition or correctness of detail, have no great reverence for ancient doctrines, no marked respect for received opinions, and who, never having been much drilled into knowledge, have little or nothing to unlearn, unanimously look on Sir Humphrey Davy as the greatest man of the age. Elegant bred scholars, however—university men—gentlemen

in love with scientific correctness and precision, possessing a mathematical cast of mind, who have been laboriously instructed in all the minutiæ of science, prefer, perhaps, the Vice-President of the Royal Society to the President, and look on Dr. Wollaston as a safer leader than Sir Humphrey Davy. Those who would jump to a knowledge of every branch of chemistry, unsparingly sweeping down whatever stands in their way, follow Dr. Ure. The inhabitants of the manufacturing districts, and those who study chiefly the chemical arts, go after Dr. Henry and Mr. Parkes; while those who are in love with abstract theory, delight in Dr. Higgins and Mr. Dalton. Drs. Thomson and Hope and Mr. Murray seem the leaders of the instructing sect of chemists, and all who wish to teach others put themselves to school under one of these eminent Professors. As there is what is called a Cockney school of literature, so there is a sort of superficial, confident chemistry, which may, perhaps, be styled the *petit maitre* school of this science; and of it Professor Brande, with the aspiring Mr. Gurney, are the chiefs. The rivalry existing between these gentlemen does not allow us to designate either of them as the undisputed sovereign of this particular sect. The first has been longest in possession of the field, but the last is a young and ambitious competitor, and seems to excite both the fear and the anger of his longer-established opponent. Now the Editor of a publication which occasionally devotes its pages to each and all of these sects—records the discoveries of Sir Humphrey, the scientific explanations of Wollaston, the dogmatic comments of Ure, the feeble descriptions of Parkes, the short and simple theories of Dalton—who bears in mind the instructions of one Professor, and repeatedly appeals to the compilation of another, and who does not disdain to levy contributions on the showy though shallow *petit maitre* school of chemistry, is dreadfully at a loss when it is necessary to place the bust of one of these gentlemen, or of some other well known chemist at the head of his pages, to show under what standard he serves. On duly weighing all these matters, a number of difficulties arose, as to which of all these great men ought to be placed in the front of THE CHEMIST; and we found it, in fact, so difficult to choose, that at length we resolved to send this Supplement into the world unadorned by the portrait of any one of our instructors, and unprotected by the name of any man of genius.

It is unquestionable, however, that the discoveries of Sir Humphrey Davy, and his well-deserved reputation, so far surpass those of every other living chemist, that no Englishman of the present day can have any hesitation in assigning

the first place to him; but his portrait is already the *ornament* of so many scientific periodicals, that had we taken it we should have had the appearance of imitating and borrowing from them—we should have given our readers nothing new. It cannot also be concealed, that the President of the Royal Society professes a sort of royal science. If in its pursuit he makes any discoveries which are useful to the multitude, they may, and welcome, have the benefit of them, but he has no appearance of labouring for the people. He brings not the science which he pursues down to their level; he stands aloof amidst dignitaries, nobles, and philosophers, and apparently takes no concern in the improvement of those classes for whom our labours are intended, and to whom we look for support. Amidst all the great efforts which have been lately made to promote scientific instruction among the working classes, and amidst all the patronage which those efforts have found among opulent and clever men, it has been with regret that we have sought in vain to trace one exertion or one smile of encouragement bestowed on such efforts by the President of the Royal Society. In fact, there is some reason to believe that Royal Societies of every description partake of the opinions and apprehensions of their patrons, and, like them, are not forward to encourage that species of instruction which tends to make the great mass of mankind the accurate judges of their merits rather than submissive scholars. It has certainly long been the fashion for those at the head of science to keep it in a manner inaccessible to the profaning touch of the vulgar, letting them see as much of it as might excite their admiration, without enabling them to estimate its value, or to acquire it by themselves. As we have not observed any very great zeal, among those who are at the tip-top of science, to assist the working classes in the numerous and glorious efforts they have lately made to procure instruction for themselves, we confess a suspicion is excited that they look with no kindly eye on these efforts, and would rather have mankind for pupils than fellow-students of the great volume of nature. If this be correct, it might perhaps be an insult to our readers to place in the front of our pages the portrait of a man who, however learned, is not learned for their utility, and who seems to take little or no interest in their improvement. It would be honouring him who takes no interest in them.

It was our intention to have given with the Supplement the portrait, accompanied by a biography, of some eminent chemist. On finding, however, that the only living English chemist who stands high above all others had been previously seized on by more than one cotemporary; that other eminent chemists were in the same situation, or, like Sir Humphrey,

had shown no great sympathy with the people's pursuits,—reflecting, too, that *we* belong to no sect, gathering from each whatever seems good, *we* deemed it more respectful to our readers, and more appropriate to the character of *our* work, not to affix any portrait as a frontispiece. At the same time, to keep our promise, we shall endeavour, in the course of our ensuing volume, to give them the biography of some eminent chemists, accompanied by their portraits.

We must now say a few words of our intentions and our labours. The Chemist was begun under an idea that the increasing importance of the science of chemistry, as well as the increasing desire among all classes for accurate knowledge, would make a weekly publication like ours acceptable to them. The support we have met with has shown that our calculations were not erroneous. Though we cannot boast of having attracted so large a share of public favour as some of our cotemporaries, we have received enough to make us acknowledge it with gratitude, and to find in it a motive for continued and greater exertions. Since the beginning of our publication, it has gone on steadily increasing in circulation, and we trust that greater efforts will ensure us a still more extensive patronage.

The object we at first proposed to ourselves was to give an outline of the principles of chemistry, with their numerous applications, as well as a history and description of all the arts which are connected with this science. In conjunction with this, it was further our intention to make The Chemist a repository of every valuable discovery, either in chemistry or the sciences connected with it, which might be made, either at home or abroad. How far the execution has corresponded with our intentions, it is not for us to say; but our readers cannot, we believe, be more sensible of our deficiencies than we are ourselves. After a mature investigation, however, we see no reason to alter the outline of our plan, though our enlarged experience will make us in future fill it up with more precision and more in detail. The elements of our forthcoming Numbers will be the same as those of the past; but we can promise that the combinations will be more numerous and the results more striking.

The Chemist.

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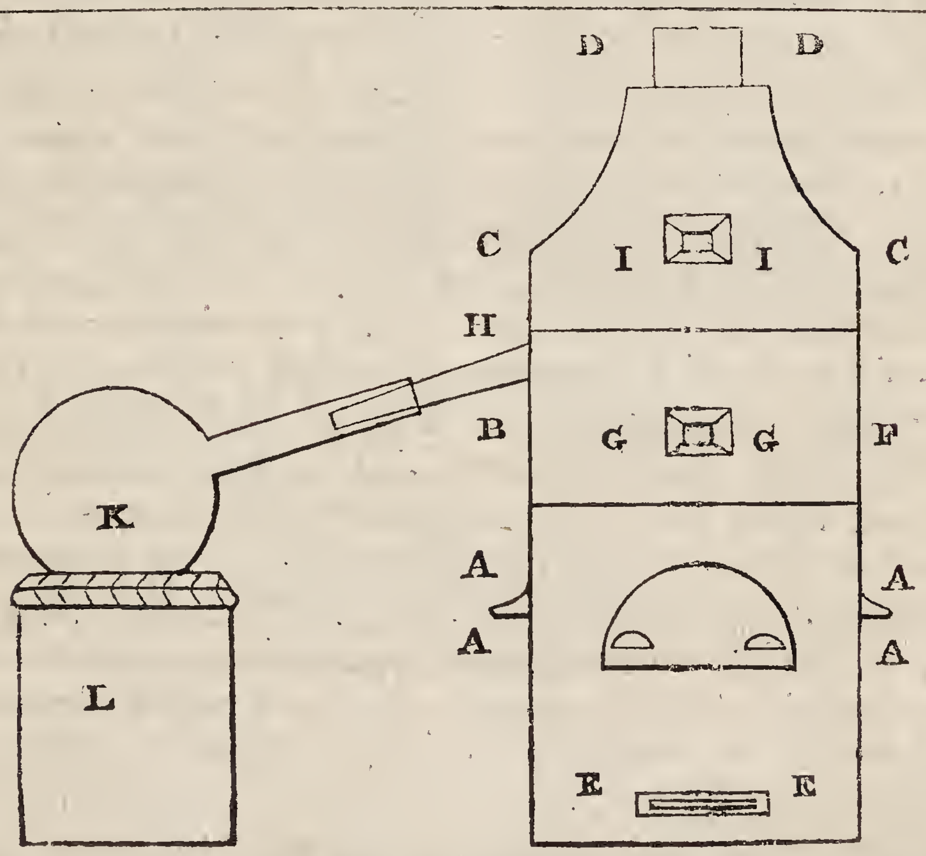
No. I.] SATURDAY, MARCH 13, 1824. [Price 3*d.*



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CHEMICAL APPARATUS.—DESCRIPTION OF THE PLATES.

In the present state of Chemistry, embracing, as it does, a prodigious variety of phenomena, numerous and expensive vessels and instruments are necessary to prosecute the study of the science with success; and in most chemical books directions are given for filling up a laboratory, which can only be done by those who are opulent, or who derive a profit from Chemistry as a business. Many chemical experiments may be carried on, however, with a simple and cheap apparatus. As the science has advanced, indeed, it has been found more useful as well as more convenient, to operate on small than on large masses of matter; and experiments, conducted on a small scale, have led to most of the bril-

liant chemical discoveries of our times. In fact, the most powerful instruments or agents for decomposing all bodies, the blow-pipe and the galvanic battery, can only be brought to act efficaciously on small quantities of any substance. By operating on grains of matter, the true nature of the diamond and the metallic bases of the alkalies were discovered; the gases have been compressed into liquids, and four metals before unknown were detected in the ores of platina. But though the chemist, who wants to make discoveries, may employ these powerful agents, and operate in this way, he must before have performed numerous experiments, and acquired not only great skill as an operator, but also an extensive knowledge of the science, before he could think of surpassing his predecessors and cotempora ries. There is obviously, there fore, two branches of experiment ing: the one, having for its object to make *discoveries*; the other, to make the experimenter acquainted with the science, and enable him hereafter to pursue successfully the other branch. To prosecute the latter assiduously, an immense apparatus is necessary, which is usually only possessed in a complete state by those persons who have to teach Chemistry. Persons who wish to study this science, without being able to acquire *all* the necessary apparatus, must not, therefore, give it up in despair. One of the chief agents in chemical decomposition is heat; and this may, in many cases, be applied by means of a common fire-place and a pair of bellows. Again, a vast number of chemical experiments, and some of the most curious ones, are made by means of the gases, which may, when they are not greedily absorbed by water, be in general obtained by the help of a few glass retorts and phials, a small lamp, and a common bason. In the course of our labours, we shall make a point of describing a number of experiments, which may be cheaply and easily performed. We have, in fact, selected one for the present Number; but we mean, at the same time, to familiarize our readers, by our plates, with all sorts of chemical apparatus; and in the present Number we present them with a representation of the furnaces generally employed by Chemists.

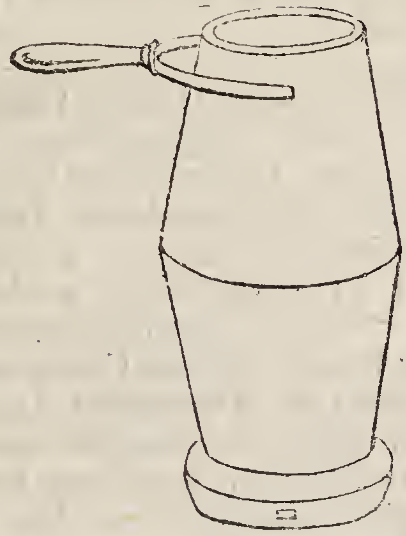
Fig. 1 is a reverberatory furnace. AA is the ash-pit. BB is the body of the furnace. CC dome, or reverberatory roof of the furnace. DD chimney. EE door of the ash-pit. FF door of the fire-place. GG handles of the body. H aperture to admit the head of the retort. II handles of the dome. K receiver. L stand of the receiver The retort is placed in the furnace at the aperture, and the neck comes out at the opening H.

Fig. 2 is a wind or air furnace, for melting bodies. A is the ash-hole. F an opening for the air. C the fire-place, containing a covered crucible, standing on a support of baked earth, which rests on the grate. D is a passage into E, the chimney. At K is an earthen or stone cover, which may be removed to supply fuel

Plates 3 and 4 represent Mr. Aikin's portable blast furnace, which is made out of the thin black lead melting-pots, in use among goldsmiths. The lower piece, C, fig. 3, is the bottom of one of these pots, cut off so low as only to leave a cavity of about an inch deep, ground smooth above and below. The middle piece, or fire-place, is a larger portion of a similar pot, about six inches deep, and perforated with blast-holes at the bottom. An upper pot is added, with a hole cut in the side, to allow of the exit of smoke and flame. It has an iron stem with a wooden handle, which may be made of an old chisel. The double bellows, D, are firmly fixed to a heavy stool, the nozzle passes into C, and the air passes into the fire-place, A. No luting is necessary in using this furnace, so that it may be taken down and put up in a very short space of time. Coke or common cinders answer well for fuel; and the heat which this little furnace

will produce is so intense, that its power was first discovered by the fusion of a thick piece of cast iron.

Fig. 4.



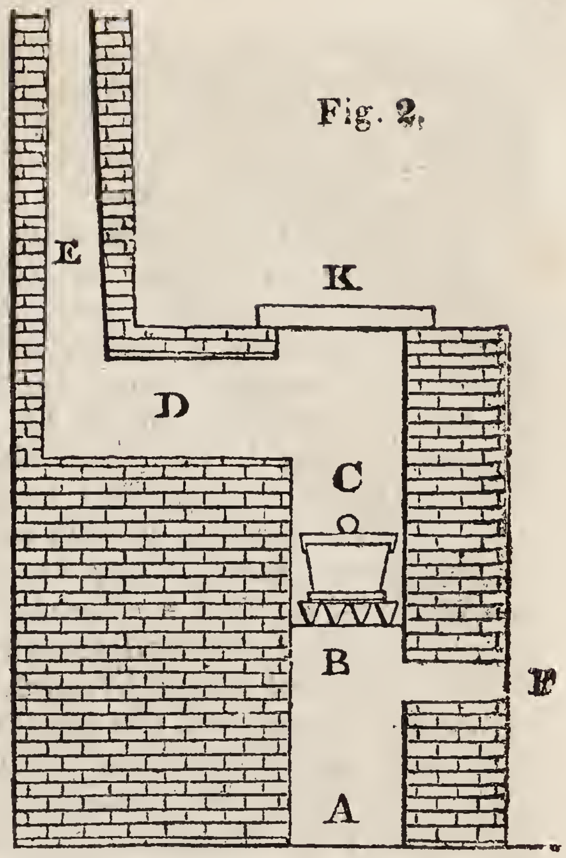
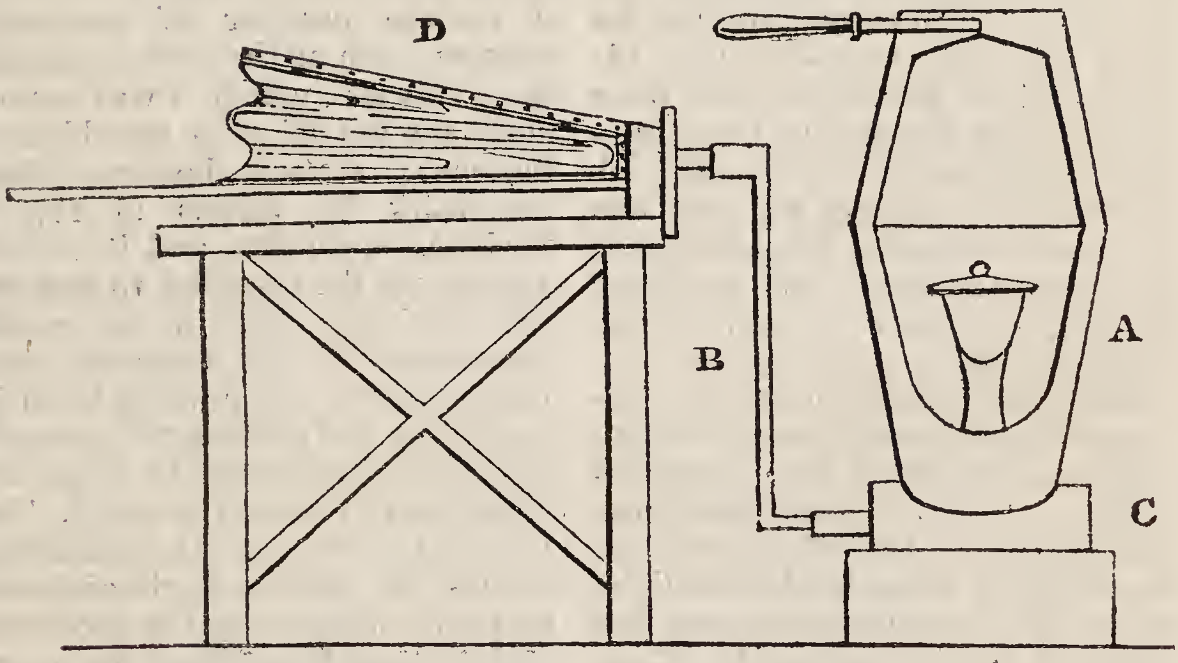


Fig. 2.

Fig. 3.



ON MAKING EXPERIMENTS.

When the study of Chemistry is pursued with zeal, numerous experiments will be made, and they can never be conducted with success, unless great order and regularity are preserved. Every vessel and utensil ought to be well cleaned as often as they are used, and put again into their place. Every one which contains any substance whatever, or which is habitually employed to contain any substance, even water, should have a label pasted on it, with the name of the substance legibly written. This may appear troublesome, but it is essentially necessary. Several substances, perfectly different in many of their properties, have precisely the same appearance, and are liable to be mistaken for one another, causing the chemist to lose all his labour. When a person is keenly engaged, experiments succeed each other quickly; some seem nearly to decide the matter, and others suggest new ideas, which he cannot but proceed to immediately; thus he is led from one to another: he thinks he shall easily know again the products of the first experiments, and therefore he does not take time to put them in order; he prosecutes

with eagerness the experiments which he has last thought of, and, in the mean time, the vessels employed, the glasses and bottles filled, so accumulate, that he cannot any longer distinguish them, or at least he is uncertain concerning many of his former products. The evil is increased if a new series of operations succeed, and occupy all the laboratory; or if he be obliged to quit it for some time, every thing then goes into confusion. Of the results of this carelessness, and multiplying vessels and utensils, we have a remarkable instance in the few anecdotes which are preserved of Peter Woolfe, an eminent alchymist of the last century, and one of the latest persons who believed in the possibility of finding the philosopher's stone, and the universal medicine, which was to give health and preserve life for ever. While in London, he lived in Barnard's-inn, and his rooms, which were extensive, were so filled with apparatus, that it was difficult to get to his fire-side. A friend of his calling on him one day, laid down his hat among the numerous packages, and such was the confusion that he could never find it again.

When new researches and inquiries are made, the mixtures, results, and products of all the operations ought to be kept a long time, distinctly labelled and registered ; for these things, when kept some time, frequently present phenomena that were not at all suspected. Many fine discoveries in chemistry have been made in this manner, and many have certainly been lost by throwing away too hastily, or neglecting the products.

Since Chemistry offers many views for the improvement of many important arts ; as it presents prospects of many useful and profitable discoveries, those who apply their labours in this way ought to be exceedingly circumspect not to be led into a useless expense of time and money. In a certain set of experiments, some one is generally of an imposing appearance, although, in reality, it is nothing more. Chemistry is full of these half successes, which serve only to deceive the unwary, to multiply the number of trials, and to lead to great expense before the fruitlessness of the search is discovered.

IMPORTANT DISCOVERY
With its Applications,
BY SIR HUMPHREY DAVY.

In the Philosophical Transactions for 1823, there is a valuable paper by Sir H. Davy, under the title, " On the Application of Liquids formed by the Condensation of Gases as Mechanical Agents :" which introduces to the notice of the world A NEW MECHANIC POWER, superior, apparently, to steam, and which may one day entirely supersede it. A few years ago, writers on the theory of mechanics laid it down as an axiom, that there were a certain number of mechanic powers, such as the *lever*, the *wedge*, the *screw*, &c., which it was impossible the wit of man should ever increase. Nature, however, does not work by means of levers, wedges, or screws, and it was reserved for the Chemist to find out the mechanic powers she really does employ. He detected them in his retorts, and applied them in cauldrons and pistons, till he needs nothing but whereon to place his apparatus to move the world. The Chemist, according to Lord Bacon's theory, is the true philosopher ; and after finding out the processes which nature employs, he overcomes her by combining her art with his own. One of her most favourite instruments is repulsion, with which every part of matter is endowed. We do not claim the discovery of this fact for the Chemists, (for it has long been known) but they have great merit in extending its application to the improvement of the arts. The changes which substances undergo, are effected by properties which belong to them or to the substances acting on them ; and few or no such changes take place, of which repulsion is not the effective cause. This natural mechanical power, if we

may so term it, is great in proportion as it is opposed. If permitted to pursue its own course, it is unseen and unfelt; and we must observe closely, remember attentively, and reason correctly, before we can discover its existence. Though the Chemist cannot be said to have found out this power, he has taught us, in a great measure, to augment it at our will, and partly to regulate its action. Of all the bodies in which it is found, those which usually assume the gaseous form seem to possess it in the greatest degree; and many of these it has lately been the great merit of Sir H. Davy to reduce to a liquid state. When in this form, and under a pressure equal to that of 20, 30, or 40 atmospheres, they have a continual tendency to resume the aeriform state, and a small increase of temperature developes a prodigious power. Thus he has caught and fixed that mighty agent which wafts and spreads them far and wide through the atmosphere, so that he can direct its action; and he is now teaching us how to apply it. If we do not mistake, the power of man over the elements seems now likely to obtain—if it may not be said to be now only begun,—a great extension; and the struggle which has been carried on since the history of our race commenced, between mind and matter, seems at length about to terminate, by the former achieving a glorious victory. But we shall not detain our readers with our remarks, but proceed to lay before them an abridgment of the Papers of Sir H. Davy and Mr. Faraday.

Mr. Faraday, in the beginning of 1823, took advantage of the cold weather to procure crystals of hydrate of chlorine, and, at the request of Sir H. Davy, subjected them to the following experiment: After being dried as well as they could be by bibulous paper, they were introduced into a sealed glass tube, the upper end of which was hermetically closed. On the tube being placed in water of 100°, the substance fused, and was filled with a bright yellow atmosphere. On examination, the tube was found to contain two fluids; one, about three-fourths of the whole, was of a pale yellow colour, having somewhat the appearance of water; the other was a heavy, bright yellow fluid, lying at the bottom of the tube, with no apparent tendency to mix with the former. As the tube cooled, the yellow atmosphere condensed with more of the yellow fluid, looking like cloride of nitrogene, and at 70′ the pale portion congealed, though even at 30′ the yellow portion did not become solid. From this experiment Mr. Faraday was led to suppose that the chlorine had been entirely separated from the water by heat, and condensed into a dry fluid by the mere pressure of its own abundant vapour. If this supposition were correct, chlorine gas, when condensed, should be compressed into the same fluid; and Mr. Faraday, subjecting this gas, after being completely dried, to a considerable degree of pressure in a tube connected with a condensing syringe, succeeded in forming the yellow fluid. This fluid is therefore considered, both by this gentleman and Sir H. Davy, as pure chlorine in a liquid state. By similar experiments, the illustrious President and his assistant succeeded in procuring liquid muriatic acid, liquid sulphurous acid, liquid sulphuretted hydrogen, liquid carbonic acid, fluid euchlorine, liquid nitrous oxide, and liquid ammonia. A number of experiments were also made on other gases, some of which, as hydrogen, oxygen, phosphuretted hydrogen, resisted condensation, though subjected to great pressure. Mr. Faraday describes, at considerable length, the properties of these various substances, in which we must for the present postpone following him, to come more immediately to the Paper of Sir H. Davy, and the application of this discovery to the arts.

Sir H. Davy, after stating that, owing to the laws according to which the elasticity of vapour increases under high pressure, some

doubts must be entertained as to the economy of employing steam under great pressures at high temperatures, says, "that no such doubts can be entertained with respect to the use of such liquids as require even for their existence a compression equal to that of the weight of 30 or 40 atmospheres; and where *common temperatures, or a slight elevation of them are sufficient* to produce an immense elastic force; and when the principal question to be discussed is, whether the effect of mechanical motion is to be most easily produced by an increase or diminution of heat by artificial means?" Sir H. Davy then goes on to say, "that he has made experiments on this subject, with the assistance of Mr. Faraday, and found that sulphuretted hydrogen, which condenses readily into a fluid at 3° Fahr., under a pressure which balances the elastic force of an atmosphere compressed to 1-14th, has its elastic force increased so as to equal that of an atmosphere compressed to 1-17th, by an increase of 47° of temperature. Liquid muriatic acid at 3 exerted an elastic force equivalent to that of an atmosphere compressed to 1-20th; by an increase of 22° it gained an elastic force equivalent to that of an atmosphere compressed to 1-25th; and by a further addition of 26°, an elastic force equivalent to that of an air condensed to 1-40th of its primitive volume." "Here, then," says an able commentator on this statement, "by alternately heating sulphuretted hydrogen gas up to 50, and cooling it down to 3 degrees, we generate a force equal to the pressure of three atmospheres. It is found," he adds, "that the elasticity thus developed varies in different gases, and that it is greatest in those which are most dense. Carbonic acid, one of the heaviest gases, has in its liquid state an elastic force equal to 20 atmospheres at 12 Fahr., but at 32 it has a force equal to 36 atmospheres; so that by the addition of 20° of heat, we generate a force equal to 16 atmospheres, or 16 times as great as that of steam in low-pressure engines." "In applying the condensed gases as mechanical agents," says Sir H. Davy, "the apparatus must be at least as strong, and as perfectly joined, as that used by Mr. Perkins in his high-pressure engine; but the small difference of temperature required to produce an elastic force equal to the pressure of many atmospheres, will render the risk of explosion extremely small. And if future experiments should realize the views here developed, *the mere difference of temperature between sunshine and shade, or air and water, or the effects of evaporation from a moist surface, will be sufficient to produce results which have hitherto been obtained only by a great expenditure of fuel.*" After stating this application of his discoveries, Sir H. Davy adds, "There can be little doubt that these general facts of the condensation of the gases will have many practical applications. They offer easy methods of impregnating liquids with carbonic acid and other gases, without the necessity of common mechanical pressure; they afford means of producing great diminutions of temperature, by the rapidity with which large quantities of liquids may be rendered aeriform; and as compression, like cold, prevents the formation of elastic fluids, there is great reason to believe that it may be successfully employed for the preservation of animal substances which serve for food."

We observe by the *Annalen der Physik, &c.* for November 1823, in which there is an account of these experiments, that the celebrated German Professor, Mr. Döbereiner, endeavoured, two years ago, to accomplish what has now been successfully performed by the English Chemist. He then remarks, It is probable, since oxygen, hydrogen, and azote, which are considered as simple substances, resist condensation, and since most of the gases condensed by Mr. Faraday are compound substances, that the chlorine operated on by him is also a compound substance, and probably contained water. The Professor considers chlorine as a compound of muriatic acid and euchlorine, or what the Chemists of our country also call protoxide of chlorine.

HOW TO MAKE ISINGLASS.

There seems little doubt that this substance, which is so extensively employed in the arts, and which consists nearly altogether of gelatine, may be made from almost any species of fish, but certainly as well from several of those species which frequent our own shores and rivers, as from those which are found in the rivers of Russia, whence we import vast quantities of Isinglass into Great Britain. The French, we observe, are making efforts to naturalize a manufactory of Isinglass in their own country; and large premiums have been offered to those persons who shall manufacture it equal to the Isinglass imported from Russia. The following is the method said to be followed in the latter country to prepare this substance, and recommended for adoption in France: The Russians divide the large air bladders of the sturgeon lengthwise, and wash them in very weak lime-water. They strip off the fine membrane or skin which covers these bladders, and wrap them up in wet linen, and bruise them and wet them till they become soft as paste. They then spread them out, afterwards roll them together, and bend the roll into the form of a heart, the two ends being fastened together by means of a wooden peg. These rolls are then suspended in the air to dry, and when dry are fit for use. The Russians, however, do not limit themselves to the swimming bladders of the sturgeon, but employ almost all the membranes and cartilaginous parts of several other fish; and it seems certain that Isinglass may be procured from almost all kinds of fish, whether they live in salt water or fresh.

AN ALCHYMIST.

THE HISTORY OF ELIAS THE ARTIST AND DR. HELVETIUS.

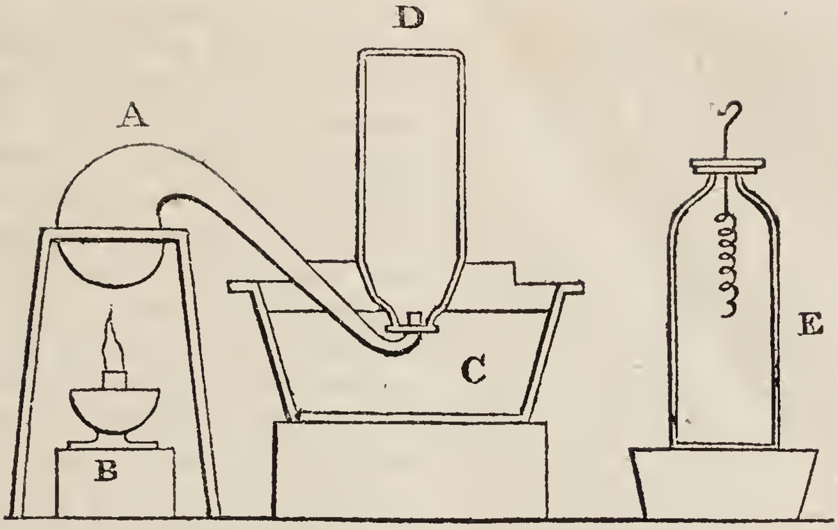
On the 27th of December 1666, says Dr. Helvetius, in the afternoon, a stranger came to my house at the Hague, in a plebeian habit, of honest gravity and serious authority, of a mean stature and a little long face, black hair not at all curled, a beardless chin, and about forty-four years of age, and born in North Holland. After salutation, he beseeched me with great reverence to pardon his rude accesses, for he was a lover of the pyrotechnical art, and having read my treatise against Sir Kenelm Digby, and observed my doubt about the philosophic mystery, induced him to ask me if I was a disbeliever as to the existence of a universal medicine which would cure all diseases, unless the principal parts were perished, or the predestined time of death come. I replied, "I have never met with an adept, or saw such a medicine, though I had fervently prayed for it." Then I said, "you are surely a learned physician." "No," said he, "I am a brass-founder, and a lover of Chemistry." He then took from his bosom-pouch a neat ivory box, and out of it three ponderous lumps of stone, each about the bigness of a walnut. I greedily saw and handled, for a quarter of an hour, this most noble substance, the value of which might be somewhere above twenty tons of gold, and having drawn from the owner many rare secrets of its valuable effects, I returned him this treasure of treasures with a most sorrowful mind, humbly beseeching him to bestow a fragment of it on me, in perpetual remembrance of him, though but the size of a coriander seed. "No, no," said he, "that is not lawful, though thou wouldst give me as many golden ducats as would fill this room, for it would have particular consequences; and if fire could be burned of fire, I would, at this instant, rather cast it all into the fiercest flames." He then asked me if I had a private chamber, whose prospect was from the public street: so I conducted him into my best furnished room back, which he entered without wiping his shoes, though they were full of snow and dirt. I now expected that he would bestow some great

secret on me, but in vain. He asked me for a piece of gold, and opening his doublet, showed me five pieces of that precious metal, which he wore on a green ribbon, and which very much excelled mine in flexibility and colour, each being the size of a small trencher. I now earnestly again craved a crumb of the stone, and at last, out of his philosophic commiseration, he gave me a morsel as large as a rape seed; but, I said, "This scanty portion will scarcely transmute four grains of lead." "Then," said he, "deliver it me back;" which I did, in hopes of receiving a greater parcel; but he, cutting off half with his nail, said, "Even this is sufficient for thee." "Sir," said I, with a dejected countenance, "what means this?" And he said, "Even that will transmute half an ounce of lead." So I gave him great thanks, and said I would try it, and reveal it to no one. He then took his leave, and said he would call again the next morning at nine. When he returned, I confessed that I had scraped off a bit with my nail, when the substance was in my hand, which I had projected in lead, but it caused no transmutation; for the whole flew away in fumes. "Friend," said he, "Thou art more dexterous in committing theft than in applying medicine. Hadst thou wrapped up thy stolen prey in yellow wax it would have transmuted the lead into gold." I then asked if the philosophic work cost much, or required long time, for philosophers say that nine or ten months are required for it. He answered, "Their writings are only to be understood by the adepts, without whom no student can prepare this mystery. Fling not away, therefore, thy money and goods in hunting out this art, for thou never shall find it." To which I replied, "As thy master showed it thee, so mayest thou perchance discover something thereof to me, who know the rudiments; and, therefore, it may be easier to add to a foundation than begin anew." "In this act," said he, "it is quite otherwise; for unless thou knowest the thing from head to heel, thou canst not break open the glassy seal of Hermes. But enough: to-morrow, at the ninth hour, I will show thee the manner of projection." But Elias never came again; so my wife, who was curious in the art whereof the worthy man had discoursed, teased me to make the experiment with the little spark of bounty the artist had left me; so I melted half an ounce of lead, upon which my wife put the said medicine. It hissed and bubbled, and in a quarter of an hour the mass of lead was transmuted into fine gold, at which we were exceedingly amazed. I took it to the goldsmith, who judged it most excellent, and willingly offered me fifty florins for each ounce.—*Brand's Manual of Chemistry.*

SUBSTITUTE FOR COCHINEAL.

In the *steppes* of the Ukraine there grows in great quantities a plant, named *polygonum minus*, which is gathered at the end of July; it is torn up by the roots, which contain a species of maggot, or insect, of an oval shape, and which hardens by being exposed to the air.

They are put into a certain quantity of water, with the addition of a little alum; and this water becomes, after a short time, of a most beautiful scarlet colour. The Cossack women, who sell it to the Russian merchants, dye their thread with it, and likewise use it to paint themselves. The Polish Jews and the Armenians sell a great deal of it to the Turks, who use it to dye their silks, to make morocco leather, and to dye the tails and manes of their horses; they even dye their own hair, their beards, and their nails with it. They call this maggot *coccus polonicus*. According to an experiment made at Moscow, a pound of these maggots, which costs a *rouble*, produces as much colour as half a pound of cochineal.



TO PROCURE OXYGEN GAS, AND BURN STEEL.

Oxygen gas, called also vital air, is one of the constituent parts of the atmosphere; and though, if breathed entirely pure, it causes a hurried and laborious respiration, it is nevertheless essential to life. Atmospheric air supports life from the oxygen it contains. Oxygen also supports combustion; with some few exceptions, its presence is necessary to combustion, and, in general, other substances only aid combustion from the quantity of oxygen they contain. It is also one of the constituent parts of water, and has been named, though perhaps erroneously, from a supposition that it was the acidifying principle. It gives sourness to many compounds, but not to all; it is a colourless elastic fluid, like common air, though somewhat heavier than it, and has neither smell nor taste; it is one of the substances the young chemist is earliest made acquainted with, and with which, from its very great importance, he continues most familiar; it may be produced in several ways. We shall give a description of two.

To obtain it in the greatest purity, put two or three drachms of chlorate of potash, also called oxymuriate of potash, into a glass retort, A, capable of holding about two ounces of water, and apply to it the heat of a spirit lamp, B. The first portions of air which arise must be rejected on account of their being mixed with the atmospheric air of the vessel; but when the salt is completely melted, oxygen gas rises in abundance.

Or this gas may be obtained by putting black oxide of manganese coarsely powdered into the retort, A; pour upon it a sufficient quantity of sulphuric acid to form a liquid paste, and then apply the heat of the lamp, and oxygen gas rises abundantly

To collect this gas, take a common earthenware bason, C, and place across it a board of four or five inches wide, and about three quarters of an inch thick, having a slit wide enough to pass the bottle, D, through, terminating in a hole, so that the bottle will stand upright. The bason is to be filled with water, and the bottle full of water is to be placed inverted in the hole. This is done by immersing the bottle in the bason, and then placing it upright, without allowing the mouth of the bottle to be ever out of the water. When the bottle is thus placed, and the atmospheric air has been expelled from the retort, carry its mouth through the water into the mouth of the bottle; the oxygen gas rises in bubbles to the top of the bottle and gradually displaces the water. The bottle then appears empty, but is, in fact, full of oxygen gas. If it is required to fill more bottles than one, a regular pneumatic apparatus is necessary, which will be hereafter described. In the mean time, having one bottle full, let us proceed to burn steel wire in it, one of the most brilliant experiments of chemistry, and which has been displayed to numerous bodies of admiring spectators.

Take a bit of steel wire, from nine to twelve inches in length, and

about 1-20th of an inch in diameter; coil it tightly round a bit of stick, half an inch in diameter, and then withdraw the stick: this will bend the wire in a spiral form. Fix one end of it into a cork, which fits the mouth of the jar or bottle in which the oxygen gas is contained, so that it may hang down when introduced into the bottle, and be kept firm by the cork, as in the figure, E,: at the other end of the wire attach a little charcoal, or thread dipped in sulphur; light the thread or the charcoal, and plunge the wire quickly into the bottle; it will instantly take fire, and throw out in all directions a number of brilliant sparks. The burning will appear in a dark room dazzling like the sun, and be, for those who have never witnessed such an experiment, inconceivably splendid. If the wire be moved with a sudden jerk during the burning, so as to throw a melted globule against the side of the glass, it will melt its way through, or lodge itself in the substance of the glass. If instead of the bottle we use a bell-glass, completely open at one end, having a mouth to which a cork is adapted at the other, and which is filled in the manner above described, but when full is removed, by a common saucer or porcelain vessel being placed beneath the open end, then the globules of the metal falling through the water on to the saucer will fuse the glazing, and fix themselves so firmly that they cannot be separated without scraping off the glazing. It is hence necessary, when performing the experiment on a small scale, to cover the bottom of the glass with sand to prevent the red hot globules from cracking it.

CHEMISTRY AS A SCIENCE.

Art. I.

Introduction.

We shall not be far wrong, we believe, in supposing that some of our readers may be totally unacquainted with the science of Chemistry, and that we shall meet their views by putting an outline of this science within their reach, in a cheap and periodical form. Without pretending, however, to draw up a whole system of Chemistry, though we shall be far from merely copying what others may have written on the subject, we shall under the present title present our readers, in a series of articles, with a short and familiar view of Chemistry as a science. While the more advanced students will find in other parts of the work information suited to their wants and their taste, the papers under the present title are intended for those persons who are beginning the study.

Every body must have observed that most of the substances around us are in a perpetual state of change, and that many of these substances act upon and destroy one another. Thus iron rusts, and is, at length, unless protected from the air, quite wasted away and destroyed; and even the hardest wood moulds and decays, so that in a few years it falls into dust and disappears from our view. Thus also wood is instantly destroyed by a few drops of vitriol; and the weakest acid corrodes iron. Now, it is a settled principle, confirmed by many observations, that substances which, like the iron and the wood, change their characteristics and appearance, are not utterly lost or annihilated: the fact is, that they are converted into some other things. The great agents in producing these changes are water and air.* What we drink, and what we breathe, therefore, while they are to us so apparently harm-

* We may here observe, for the satisfaction of scientific readers, that we do not include fire or caloric among these active agents, because, as must be known to them, there are among the best informed chemists differences of opinion, whether caloric be a separate substance, or only a property of all matter. If the former, we are wrong in omitting it; if the latter, it would be as improper to include it, as to include *wind*, which all philosophers know to be merely a movement—synonymous with a property—of air.

less, so really beneficial, and even so necessary to our health and our existence, are also the causes of those numerous changes which are constantly going on before our eyes, and which are called decay and destruction. That the same principles which warm every being into life also bring on decay and destruction, is a fact which we shall often have occasion to advert to and illustrate: we only briefly allude to it now in mentioning those numerous changes which are going on in every thing around. The whole surface of the globe, in fact, the whole universe is perpetually and periodically changing; but all these changes take place without the annihilation of any portion of matter.

Some of these changes are accompanied by a perceptible motion; thus the waters of the ocean daily rise and fall: others are not so accompanied; thus the state of iron and wood is gradually altered, and nothing but the familiarity of the alterations keeps us from wondering at their cause. It is the object of mechanical philosophy to explain those alterations which are accompanied by perceptible motion; and it is the object of Chemistry, by ascertaining the peculiar properties of all bodies, to explain those which are not. This is what gives dignity and interest to the science. As long as Chemistry was a mere art, confined to producing a few results, of use only to a few practical Chemists, it was of no more general interest, however useful, than the art of house-building or shoe-making; but now, in addition to its utility as an art, it endeavours to explain most of the alterations, unaccompanied by perceptible motion, which take place in all the substances of the globe.

It has been already stated that there is no annihilation; there must be therefore some things which are changed or altered. Formerly it was supposed that all these alterations were effected in four elementary substances, viz. fire, earth, water, and air; and so powerful has been the influence of this supposition, which originated many centuries ago with the ancient Egyptians or Greeks, that it now forms a part of the popular belief throughout Europe. The four elements are frequently talked of, and were not long ago taught as the bases of some sciences. It is the business of the Chemist to ascertain, if he can, what are the actual elementary bodies of which every one of the different objects of the globe are composed. Some are submitted to the action of fire, others to that of powerful solvents; some are exposed to the action of water, and others are submitted to electricity; and by all these, and various other means, he endeavours to discover the different simple or elementary substances which undergo all these changes. When, by all the means which he can invent, he cannot change or decompose one substance into two others, it is called a simple substance, or an element. In the language of Chemistry, therefore, the term elements signifies those bodies which the Chemist has not been able by his art to decompose. Unfortunately for the chemistry of the ancient world, and the theory of four elements, they havec all been decomposed by the art of modern chemists. We shall hereafter point out their composition; to do it now would draw us aside from our principal subject. In place of them, modern Chemists are at present acquainted with, according to some writers, fifty-seven, and according to others, fifty-two different substances, which they have not yet been able to change or decompose. It is, however, remarkable, that few or none of these substances are ever found in a natural state; and they are nearly all of them the produce of the chemist's art. All the substances and things of the globe, whether animals, minerals, vegetables, or *airs*, (gases) which have hitherto been subjected to chemical examination, and there are perhaps very few unexamined, are found to consist of one or several of these elementary bodies. They are like

the letters of the alphabet, with which we put together all our words, and of them is this whole world of wonders composed. Nay, there is good reason to believe, as the science of Chemistry, which is yet in its infancy, advances to perfection, that this list of elementary substances will be decreased. To decompose them is one great object of the scientific Chemist's ambition; and we trust many of our readers, when they have acquired a knowledge of the science, as it now exists, will turn their attention to its improvement.

There are two modes in which a knowledge of these elementary substances may be conveyed to the student of chemistry. The first is, to show him, by going through an analysis of every known substance, of what elements it consists; the other is simply to bring these elements before him in succession. The former would, in fact, be making him do what others have done for him; the other is applying to his immediate instruction the discoveries and knowledge of others. We prefer the latter as more simple, and shall, in our next Article, proceed to describe the substances which, never having been yet decomposed, are considered as elementary or simple substances.

TESTS FOR ARSENIC.

The use which is sometimes made of this substance to destroy life, makes a knowledge of the means of detecting its presence of great practical utility. The substance sold under the name of arsenic in the shops, is called *arsenious acid*, or *white oxide of arsenic*, by chemists: the former name being, at present, more in use than the latter. The term arsenic is applied by chemists to a metallic substance obtained from arsenious acid, and which they consider to be a distinct metal. With its properties we have now nothing to do, as this paper is to be devoted to the virulent poison, called arsenic in the shops, and arsenious acid by the chemists.

It is a white brittle substance, has a sharp acrid taste, which at last leaves an impression of sweetness and a very peculiar smell, somewhat like that of garlic. When the arsenious acid is thrown on red hot coals, it evaporates in white fumes, and this peculiar smell is then very perceptible. It is rather more than three and a half times as heavy as water; and though it may be suspended in this fluid by agitation, it soon subsides if the agitation is put a stop to. Boiling water will dissolve a quantity about equal in weight to the fourteenth part of the water. Cold water only dissolves about one tenth part as much as boiling water. Other authorities say it is soluble in thirteen times its weight of boiling, and eighty times its weight of cold water. Water in which arsenious acid has been dissolved, reddens litmus paper, as well as the most sensible of the blue vegetable colours, but it turns the syrup of violets green. If lime water be added in sufficient quantity to the solution of arsenious acid, a fine white precipitate, which is arsenite of lime, is perceptible. Sulphuretted hydrogen gas and hydrosulphuretted water precipitate a golden yellow sulphuret of arsenic; and by this test a portion of arsenious acid in water, not greater than a hundred thousandth part of the whole, may be detected. If this yellow sulphuret be dried on a filter, and heated in a glass tube with a bit of caustic potash, it will, in a few minutes, be decomposed: sulphuret of potash will remain at the bottom, and metallic arsenic, of a bright steel lustre, which sublimes, will be found coating the sides of the tube. Nitrate of silver is decomposed by arsenious acid, and an arsenite of silver, of a very peculiar yellow colour, is precipitated. To prevent this precipitate being dissolved by nitric acid, which is very often present, a small quantity of ammonia is added; and even this, if too much is added, is also likely to re-dissolve the silver precipitate.

To ascertain if arsenious acid has been administered, the first

thing to be attended to is the state of the patient. The symptoms resulting from administering a dose of arsenic capable of destroying life have been thus described. In about one quarter of an hour after taking the poison, sickness and great distress of stomach come on, followed by thirst and burning heat in the bowels; violent vomiting, severe gripings, and excessive and painful purging then ensue; then come faintings, with cold sweats and great debility; painful cramps and contractions of the legs and thighs succeed, with extreme weakness, and then death puts an end to these severe sufferings. In the progress of the dissolution the teeth are set on edge; the matter vomitted is of a brown or bloody nature; the stools are of an indescribable fœtor; the pulse is frequent and irregular, the heart palpitates, the thirst is inextinguishable, the urine is of a red or bloody appearance; a livid circle comes round each eye, the whole body itches, and is covered with livid spots; the hair falls off the skin, comes away, and horrible convulsions usher in death. All these symptoms are seldom combined in the same individual, and sometimes they are altogether wanting. Mr. Earle has given a case of a woman resisting the effects of arsenic for four days: then she died; and, on being opened, the stomach and intestines were found to be most extensively ulcerated. Another instance is recorded by M. Chaussier, of a robust man who had taken arsenious acid, and died without any other symptoms than slight syncopes. On his stomach, the poison was found in the same state in which he swallowed it, and there was no appearance even of inflammation in the intestinal canal. In general, however, inflammation extends along the whole of this canal, from the mouth to the rectum. The above exceptions show, that neither state of the bowels is a decisive proof that poison has been administered. All these symptoms and results, even to the inflammation and ulceration of the bowels, and of course death, are also produced by the application of arsenious acid to external wounds. There is reason to believe that the inflammation of the stomach is more violent, when so applied, than when taken inwardly, which shows that it is not the immediate action of the arsenious acid on the stomach, but on the whole system, which produces death; and the stomach itself is only affected by some inexplicable alteration in the blood or nervous system.

When any symptoms, such as these now described, make it necessary to examine the contents of the stomach chemically, after the body is opened, a ligature should be tied round the œsophagus and round the beginning of the colon, and the intermediate stomach and intestines removed. Their liquid contents should be emptied into a vessel, and the stomach should be well washed with warm water. It has long ago been remarked, that the mixture of various substances, such as beer, tea, wine, oil, or soup, in the alimentary canal, make it difficult to detect arsenious acid, owing to these substances imparting peculiar colours to the tests, and preventing the arsenious indications. This difficulty has been lately removed by Mr. Phillips, who proposes, in an article published in a late Number in the Annals of Philosophy, that ivory black (animal charcoal) should be employed for this purpose. After making repeated experiments, he found, that by mixing ivory black with a coloured solution of arsenious acid, the colouring matter was in a few minutes so completely destroyed, that the usual tests might be readily applied. "Supposing," he continues, "the substance suspected to contain arsenious acid to have been boiled in distilled or pure water, and deprived of colouring matter by mixing ivory black with it, the test to which it may first be subjected is a solution of sulphuretted hydrogen gas in water." To this solution, which is clear and colourless, add, in a

wine-glass or phial, some of the suspected fluid; if it contain arsenious acid, a yellow coloured fluid will be produced, and after a few hours a yellow precipitate will fall down. Antimony produces a similar precipitate, but immediately, and the colour is darker.

Another test is sulphuret of copper. Add a few drops of an alkaline solution to the suspected liquid, and when mixed pour them into the sulphuret of copper; if arsenious acid be present, a green precipitate will be formed. To be certain that the sulphuret of copper contains no per-oxide of iron, add first to the solution some potash, if pure, a fine blue precipitate will be obtained; to this add the suspected liquid, and if arsenious acid be present, the blue precipitate will be converted to a green one. Nitrate of silver may now be applied to confirm the evidence of the other two tests. This was long considered as the most delicate, and one of the most decisive tests; but it has been observed that the alkaline phosphates produce, with silver, precipitates analogous in appearance to the arsenite of silver. This causes an ambiguity, which seems obviated, however, by a method recently proposed by Mr. Smithson, and improved by Mr. Phillips. It is this: put a little of the suspected solution into a glass tube or the bottom of an oil flask, drop into it a small crystal of nitre, evaporate the solution to dryness, and then heat it strongly in the same way. Add distilled water to the residuum, dissolve it, and then add nitrate of silver, if the solution, before heating, contained arsenious acid, it will now contain arsenite of potash, and a brick red precipitate will be the consequence of adding the nitrate of silver. When this test agrees with the others, the presence of arsenious acid in the substance operated on may be considered as proved. There is, however, still another and more conclusive test, which consists in reducing the arsenic contained in the acid to its metallic state. It has often been found difficult to effect this, unless the arsenious acid was in considerable quantities; but Dr. T. S. Traill has lately published the following method of reducing the arsenic contained in very small quantities of arsenious acid to its metallic state: take a thin glass tube two inches and a half long and nearly half an inch in diameter; it should be closed at one end, and the open end should be slightly dilated like the common test tubes of the blow-pipe apparatus. By means of a piece of copper wire twisted round the upper part it can be attached to any convenient support at an angle of 35 deg., and its close end subjected to the flame of a spirit lamp. Put into this, with the substance suspected to be arsenious acid, black flux, or potash mixed with charcoal powder, to at least three times its weight; if the quantity is not very minute, to mix them with the point of a knife on writing paper before putting them in is sufficient: if it is minute, the two substances had better be mixed together in an agate mortar. The tube should be dry and clean, and its mouth may be stopped slightly with paper. After the substances are put into the tube, the lamp is placed under the closed end, and will soon raise it to a dull red heat; in less than two minutes, if arsenious acid be present, a shining metal crust will invest the upper side of the inclined tube, about half an inch from the flame. The tube may be preserved for further use, by shaking out the loose materials when it is cold, and scraping off the metallic crust from the inside. By this means, says Dr. Trail, I have succeeded in reducing less than one-tenth of a grain of arsenious acid to the metallic state; the metallic crust was distinct to the eye, and very conspicuous when a lens was employed.

AGE OF VEGETABLES.

All our readers know that there is a prodigious diversity in the age of vegetables or plants. Some live only for a few months, and others for a thousand years. Though the

apparent diversity amongst them is great, they are all reduced, as to their time of living, by some philosophers, into three classes—those which arise in spring and die in autumn, those which live two years, and those which exist for a space betwixt four years and a thousand years. Plants which are of a soft, watery nature, and have tender organs, live only one, or, at most, two years; while those which have thicker juices, and stronger organs, with hard wood, live for many years. Among the short-lived ones, those which are almost destitute of taste and smell, do not, as a general rule, live so long as those which possess more volatile oil, and are of a fragrant nature. All sorts of corn, for example, live only a year, while common thyme, marjorum, wormwood, and hyssop, contrive to live for several. Bushes and small trees live from 60 to 100 years; and the vine, even in its hundredth year, has been known to be fruitful. Ivy and *acanthus* live more than 100 years; and the forest trees, such as oaks, chesnuts, beech, palm trees, olive trees, mulberry trees, the basbab, and cedars, live for 1000 years. Some of the cedars of Lebanon (famous in remotest antiquity, as all readers of the Bible know, and in modern times for its fine forests,) have lived more than 1000 years. In Sicily there is a chesnut tree, called *di centi cavalli*, or "of a hundred horsemen," from so many having found shelter under its branches, also supposed to be more than 1000 years old: and there are still standing, in some of the forests of Germany, oak trees which are supposed to have served as temples for the Druids, and to have witnessed their superstitious rites. In Dodsley's Annual Register for 1758, an oak is mentioned as standing in Langley Wood, near Downton, Wiltshire, the property of the Bishop of Salisbury, which was supposed to be near 1000 years old. An oak was cut down not many years ago, at Morley, in Cheshire, which could be traced backwards for 800 years, and under which Edward the Black Prince is said to have dined. In general, trees which grow quick do not live long, as pines, poplars, &c.; and the oak, which grows remarkably slow, and makes very hard wood, lives for a great length of time. In general, those which bear sweet and well-tasted fruits do not live so long as those which bear bad fruits, or do not bear any; and another difference observed is, that those which bear nuts live longer than those which bear berries or fruit with stones. Apple, apricot, cherry, and peach trees, however, live upwards of 60 years, and even longer, when they are carefully cleaned of the moss. In general, also, cultivated trees do not live so long as those which grow wild. When the earth about the roots of trees is dug up or loosened every year, they put forth leaves with greater vigour, and produce more fruit; but it has a remarkable effect in diminishing the length of their lives. On the contrary, it has been observed, that if this takes place only once every eight or ten years, it adds to the length of time they remain in a fruit-bearing condition. Cultivation of all kinds seems to hasten on the production, but it diminishes the number of years the plants live. Cutting and trimming plants adds to their existence. Lavender, when frequently cut and trimmed, has been known to live for more than 40 years.

HYDRAULICS.

CURIOUS EXPERIMENT.

The following experiment has recently been exhibited in the northern part of this country, by a celebrated professor. A jet of water, by means of a great pressure, was made to spout upwards, and bear aloft, almost as high as the ceiling, a hollow copper ball as large as an egg; and sometimes an egg itself is used. The water was made to spout up in one unbroken jet, about the thickness of a lady's finger. Striking the ball on the under side, it spread out into a thin shell or film, which invested the globular surface on all sides,

land afterwards descended in rain or spray. The ball kept playing on the top of the jet, not leaping up and down, but vibrating a little from side to side, and generally it performed at the same time a slow vertical motion on its axis. It is remarkable, that it is not necessary for the water to rise in a vertical direction. The experiment succeeded, and the ball was supported equally well, when the jet was inclined ten or fifteen degrees.

A mode of Drying Damp Walls.—It very often happens that apartments on the ground floor, particularly if the house be situated near a common sewer or other receptacle for filth, are so damp that they cannot be successfully papered; and, if papered, the paper soon moulders and decays. To remedy such an evil, the following plan is recommended in a French journal: There was a large room which was always damp, and after a variety of means had been employed to render the walls dry, it was resolved to pull them down. Under these circumstances, it was recommended to wash them with sulphuric acid, which was done, the deliquescent salts were decomposed, and the room was afterwards perfectly dry.

SUBSTANCE FOUND IN THE MANUFACTURE OF PYROLIGNOUS ACID.

Of late this acid has attracted, and very deservedly, both from its scientific importance and its use in several arts, the attention of some of the most eminent modern Chemists; and various accounts have of late been published of the best means of obtaining it, and of its properties. M. M. Macaire and Marcel have lately published, in a foreign journal, an account of a particular substance found during the rectification of this acid. It is perfectly transparent, having a strong grateful smell like ether. When evaporated from the hand it exhales an odour like oil of turpentine. Its taste is strong peppery, and burns the mouth. Distilled overy dry muriat of lime, its specific gravity is found to be 0.828. It boils at 65 5 of the centegrade thermometer, or 142.9 Fahr. It combines in any proportion with alcohol, forms an emulsion with water, and will not unite with oil of turpentine. On subjecting it to analysis, by means of the oxide of copper, it was found to contain—

Carbon	44 53
Oxygen	46.31
Hydrogen	9.16

The pyro-acetic spirit, analysed by the same means, was found to contain in the 100 parts—

Carbon	55.30
Oxygen	36.50
Hydrogen	8.20

A 100 parts of alcohol, of the specific gravity of 0.820, gave—

Carbon	48.8
Oxygen	39.9
Hydrogen	11.3

Bulletin des Sciences Technologiques, *Jan.* 1824.

Whence these authors conclude that there exists at least two distinct simple vegetable fluids, which, like alcohol, form ethers with acids, and that these two fluids, which may be called the pyroacetic spirit, and the pyroxylic, differ from one another in their properties and in their composition.

Communications received at the Publishers', Messrs. KNIGHT and LACEY, 24, Paternoster Row.

B. Bensley, Bolt-court, Fleet-street, London.

The Chemist.

"——— Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

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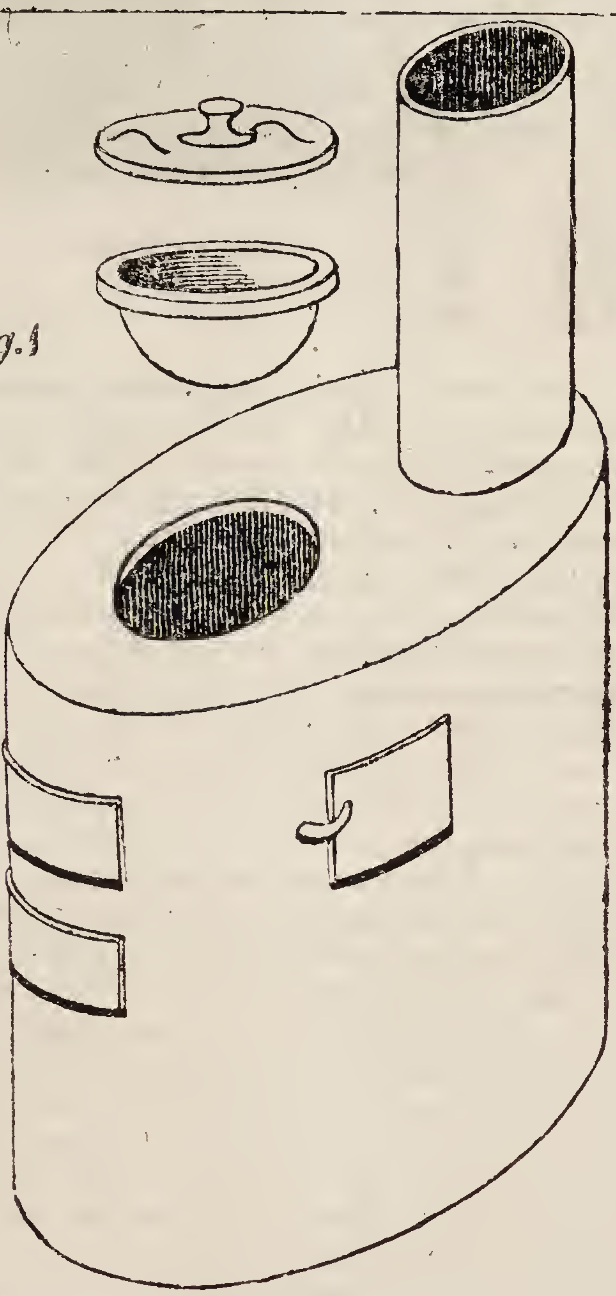


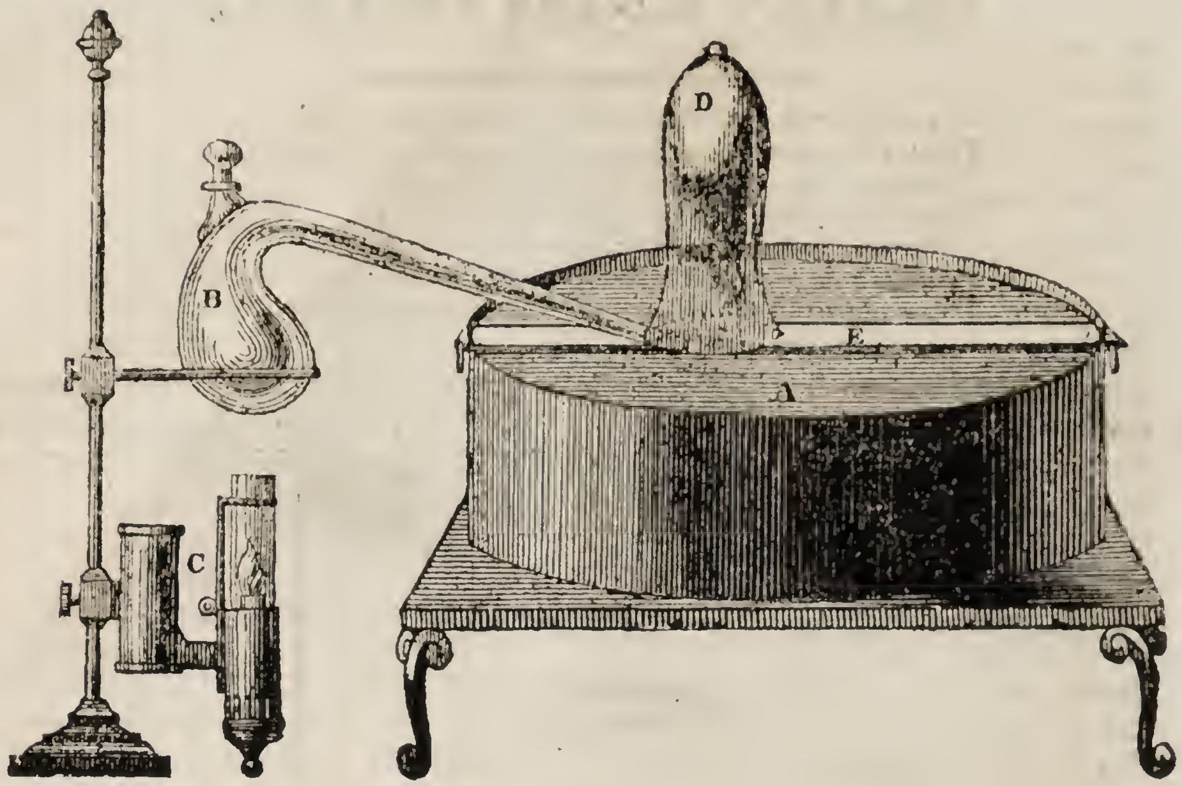
Fig. 1

CONTENTS.

CHEMICAL APPARATUS.

Description of the Plates.

Fig. 1 represents Mr. Knight's portable furnace, which may be employed for a variety of purposes. The other Plate is the representation of part of the apparatus used in collecting gases. It consists of what is called a pneumatic trough, A; glass retort, B; common lamp for applying heat, C; and glass vessel, D, for receiving the gas.



The trough is made of wood, lined with lead, or tinned copper. Any shape serves; but an oval form is generally found to answer best. It should be from 6 to 12 inches deep, from 20 to 28 inches long, and from 12 to 15 inches wide. A moveable shelf, E, nearly half the breadth of the trough, perforated with several large holes, or having a slit along the middle, is placed lengthwise in it, at the depth of at least two inches, and the trough is to be filled with water, at least one inch above the shelf. If the glass vessel, D, with its mouth downwards, be immersed in the tub, filled with water, and then placed inverted on the shelf, provided the mouth of the vessel be kept constantly below the surface of the water, it will remain full. This effect is produced by the pressure of the atmosphere, which sustains the water in the upper part of the glass, in the same manner as the mercury is sustained in the barometer. If, however, common air, or any other elastic fluid of equal lightness and elasticity, and not greedily absorbed by water, be suffered to enter the glass vessel, it will rise to the top. On this principle, when it is required to collect any gas or aëriform substance, the mouth of a tube, from which it is to issue, is immersed in the water directly under the glass, D, when it rises to the top, gradually displaces the water, and causes it to fall to the level of the water in the trough. When one glass is full, it may be slid along the shelf out of the way, and another placed over the ascending gas; or it may be wholly removed, by sliding it off the shelf into a saucer, held on a level with the shelf, and of course somewhat under the surface of the water. In this way any quantity of gas may be obtained, and employed for making experiments.

We come now to the method of pouring gas from one vessel into another. Our readers must all have observed, that if a tumbler or wine glass, in that state which is usually called empty, but in which it is, in fact, filled with air, be plunged into water with its mouth downwards, so that the air cannot escape, scarcely any water will rise in the glass, because its entrance is opposed by the air already contained in it; but if the mouth of the glass be turned upwards, the air immediately escapes in bubbles through the water, and the glass is filled with that fluid. If a vessel full of atmospheric air, or of any of the gases, be plunged in water in this manner, and its mouth turned up directly under the opening of the inverted glass, D, on the shelf, the included air can only escape into D, atmosphe-

ric air cannot find admittance, and, in this way, gases or air may be emptied from one vessel into another, without suffering any change. Gases which are considerably heavier than atmospheric air, or than the air they are to displace, may be poured like water into a vessel full of atmospheric air, or full of a gas lighter than themselves. Some gases, however, are absorbed by water, or water effects an alteration in them; and such gases are treated in the manner here described, mercury or quicksilver being substituted for the water. In this case, as the mercury is a costly article, a smaller trough is used, and as it is very weighty, the trough is hollowed out of a solid block of hard wood or marble; and a small rod is placed across the trough, a few inches above it, and by means of which, to prevent accidents, the jar filled with mercury may be supported.

This method of obtaining and confining a particular species of air, was invented by Dr. Mayow, and afterwards improved by Dr. Hales. To Dr. Priestly we are indebted for the present pneumatic apparatus; and to him, Mr. Watt, of Birmingham, and Lavoisier, the science owes most of the improvements that, in later times, have been made in the mode of operating on gases.

In making chemical experiments, great care is always requisite in making the joining of all the vessels, tubes, retorts, &c. air tight. For some purposes, it is sufficient if the glass vessels are made to fit close by being ground with emery; but in most cases this is effected by what the Chemists call lutes, and the operation is called luting. The lutes, with which the joinings of vessels are closed, are of different kinds, according to the nature of the operations to be made, and of the substances to be distilled in these vessels.

When vapours of watery liquors, and such as are not corrosive, are to be contained, it is sufficient to surround the joining of the receiver to the nose of the alembic, or of the retort, with slips of paper or of linen, covered with flour paste. In such cases also, slips of wet bladder answer very well.

When more penetrating and dissolving vapours are to be contained, a lute is to be employed, of quick-lime slaked in the air, and beaten into a liquid paste with whites of eggs. This paste is to be spread upon linen slips, which are to be applied exactly to the joining of the vessels. This lute is very convenient, easily dries, becomes solid and sufficiently firm. Of this lute vessels may be formed hard enough to bear polishing on the wheel.

Lastly, when acid and corrosive vapours are to be contained, we must then have recourse to the lute called *fat lute*. This lute is made by forming into a paste some dried clay, finely powdered, sifted through a silken searce, and moistened with water; and then, by beating this paste well in a mortar with boiled linseed oil, which has been rendered drying, by litharge dissolved in it, and fit for the use of painters. This lute easily takes and retains the form given to it. It is generally rolled into cylinders of a convenient size. These are to be applied, by flattening them, to the joinings of the vessel, which ought to be perfectly dry, because the least moisture would prevent the lute from adhering. When the joinings are well closed with this fat lute, the whole is to be covered with slips of linen, spread with lute of lime and whites of eggs. These slips are to be fastened with packthread. The second lute is necessary to keep on the fat lute, because this latter remains soft, and does not become solid enough to stick on alone.

Fine porcelain clay, mixed with a solution of borax, is well adapted to iron vessels, the part received into an aperture being smeared with it

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EMETINE AND MORPHIA.

The very subtile nature of the two poisons, the names of which stand at the head of this article

and the recent use made of one of them, and of a preparation of the other, in a neighbouring kingdom, to destroy life, under the expectation, we are glad to say vain expectation, of escaping punishment, by the poisons leaving no trace of their operation, may give rise to objections as to our propagating a knowledge of their existence and properties. We foresee that those who have no confidence in the virtues of mankind, and who live under the influence of the agonizing theory of man being naturally the enemy of man, and who suppose that the species are ready at all times to prey on one another, will cry out against us for putting the means of perpetrating mischief into the hands of a race which they are always ready to call wicked and detestable. Monuments of piety, examples of splendid virtue, or long continued patience and self-denial, have no influence over those whose minds are imbued with a theory of man being contaminated by that matter he renders subservient to his improvement. His continued progress towards a better state of things, his repeated triumphs over the elements, his brilliant discoveries of hidden properties, by which he makes the ocean the footpath of nations, and the winds the messengers of his will;—the trophies of his conquests and his power, which are every where around us, showing that there is nothing which art and industry cannot achieve, and nothing except that Great Power which created both man and the elements, superior to him;—all are lost on them, and they can never place any confidence in a race which they persist in denominating, in spite of all these facts, fallen and degraded. Belonging themselves to this race, is not sufficient to stop their calumnies. They would have no limits to their own power or their own knowledge; for each one amongst them holds himself to be an exception to the general laws they propound with so much self-complacency, as guiding the conduct of other men; but all other men they would have kept in ignorance and darkness, as if they were anxious, for the sake of their own reputation, to realize their theories of the wicked nature of man. Such people will be apt to exclaim, "What! when you see every day attempts made to destroy life, by administering various corrosive poisons; when the almost certainty of detection and the dread of punishment cannot stay the arm of the murderer—will you spread among the people a knowledge of poisons equally efficacious in destroying life, but effecting it by such hidden means, that the most skilful chemists and the best instructed physicians differ in their opinions as to the visible effects of such substances, and doubt the possibility of detecting them when administered?" Though we do not ourselves share in these fears, and do not think one more life will be destroyed by a more extensive knowledge of the means by which this diabolical purpose may be effected, yet as we foresee that an objection of this kind may be, and will be made to the present article, we reply to it beforehand. We shall disarm our opponents, by showing them that they cannot use their weapons to our annoyance.

It is a fact, that such substances as these exist in nature, or may be and have been prepared by art; and a knowledge of the means of preparing them cannot be extirpated. Of their employment we have a recent example. In the month of November last year, a Doctor Castaing was tried and executed at Paris, for one of the most diabolical murders on record. He was the friend and medical adviser of two brothers, who had been brought up to the profession of the law, and who possessed considerable property. They both died, one after the other, within a few months, while under his care, leaving him the heir to considerable property. By the death of the first, the second brother acquired all his wealth, and whether he shared the guilt of Castaing in the first instance, or

was totally ignorant of that crime by which he profited for a season, does not appear, but he continued to live on good terms with Castaing. At length, however, he too fell a victim to the arts of this man; but, as his death was sudden and unexpected, it gave rise to several suspicions, and they being confirmed by Doctor Castaing's conduct as to the property, he was taken up and tried. After a minute investigation, he was acquitted of the charge of murdering the brother who died first, because his death had taken place some time before, and no investigation having then been made, no conclusive proof could be brought against him, though there was strong reason to suspect him of having also perpetrated that; but he was found guilty of murdering the second, by administering to him doses of Emetine and of acetat of Morphia. Dr. Castaing, it appeared on the trial, had long been in the habit of making experiments on poisons, with a view of ascertaining what substances unite with their poisonous qualities the treachery of leaving no trace of their operation; and so effectually had he succeeded, as almost to realize the stories which were once circulated of the famous woman at Rome, and whose skill was afterwards imported into Paris, who could poison whom she pleased, and no trace be left of the means by which she accomplished her murderous purpose. Having free access to his victims, and having them, in fact, almost under his exclusive superintendence and management, he was able to operate on them as he pleased; and so artfully did he contrive it, administering the poison in small doses, and keeping his patient constantly sick till he died, that no suspicion was caused by the death of the first brother, and no conclusive evidence could be produced that he had poisoned the other. Suspicion alighted on him from his conduct betraying a consciousness of guilt, and no certain proof was brought forward at the trial, either that he had administered poison, or that his victim had died of poison. The most celebrated chemists and physicians of Paris, and amongst them the original discoverers of one of these substances, were employed to examine the body, and were called up as witnesses on the trial, and they differed in their opinions as to the possibility of detecting these poisons when mixed with alimentary matters, or ascertaining their visible effects on the organization of the frame.

Such being the state of the case, it becomes a question, whether it is right to diffuse a knowledge of these substances through the community, or whether attempts should be made to confine that knowledge to a select few. We have answered to ourselves this question in the affirmative, and we shall briefly state why.

In the first place, we say that the great motive which restrains such men as may otherwise be disposed to commit atrocious crimes, is, of course, the fear of detection. Now, as long as society is generally ignorant of the existence of any such subtle poisons as are here described, it is clear that those who possess a knowledge of them may poison people unsuspected; and that the most powerful check which can be devised against such an employment of these materials, is to put people on their guard against them. Suspicion will, in such a case, be in proportion to knowledge; and thus, by making the whole matter known, we generate in those who may now possess this knowledge, a fear of being suspected, which, without this, could never arise, and every one would be confident of escaping detection. We say that this knowledge, as far as it can be employed for evil, already exists; and that by making it more general, we only multiply the means of preventing that particular application of it which is here alluded to.

But is there any reason to believe it will be so applied to any extent? We answer, No; for as soon as the matter is generally

known, all temptation to employ these poisons in preference to others, disappears. Leaving the secret in possession of a few individuals would give them a power of perpetrating any crimes they pleased; but no man will commit an action of which he believes every one will suspect him. Independent of this, these substances are powerful and very useful medicines; and shall we be withheld from making their properties known, because some persons may misapply them? Why, there is not a single weapon or a single instrument invented by man, which may not be mischievously employed; and if we were to act on this principle of limiting man's knowledge and powers, because he may abuse them, we should tie every man's hand to prevent them all turning pickpockets. We leave such precautions and such principles to those who have a worse opinion than we have of our fellow-creatures; and shall never attempt, either by our silence or our reprobation, to check the diffusion of any species of knowledge; —except, indeed, the diffusion of such unsound theories as lead men to place an overweening confidence in themselves, and cherish the darkest mistrust of all other men.

Emetine is extracted from the drug called Ipecacuanha, and is so named because it constitutes the part of this medicine which occasions vomiting. It was first extracted from it by Messrs. Majendie and Pelletier, French Chemists, by the following method, which is still employed:—Ipecacuanha was digested first in sulphuric ether, and then in alcohol. The solution in alcohol was evaporated to dryness, re-dissolved in water, and acetat of lead dropped in the solution. A copious precipitate fell, which being edulcorated and diffused through water, was exposed to a current of sulphuretted hydrogen gas. The lead was precipitated in the state of sulphuret, and the emetine dissolved in water. The liquid being filtered and evaporated to dryness, the residue consisted of emetine in a state of purity. It possesses the following properties:—It consists of transparent scales of a brownish red colour, having no smell, and being of a bitter and acrid, but not nauseous taste. When exposed to a heat greater than that of boiling water, it swells, blackens, and is decomposed; furnishing water, carbonic acid, a little oil and acetic acid, a very light coal remaining behind.* When exposed to damp air, it becomes moist, and it dissolves readily in water, but cannot be made to crystallize. It is soluble in alcohol, and insoluble in sulphuric ether. Concentrated sulphuric acid chars and destroys it. Nitric acid, either hot or cold, dissolves it, and forms a fine red coloured solution, which gradually becomes yellow; while nitrous gas exhales, and crystals of oxalic acid are formed, but no yellow bitter principle. Muriatic and phosphoric acid dissolve it without alteration, and let it fall again when they are saturated with an alkali. Acetic acid is one of the best solvents of it. Gallic acid precipitates it of a dirty white colour. Half a grain of Emetine, when swallowed, occasions severe vomiting, followed by sleep, and the animal awakens in a state of health. Six grains produce vomiting, followed by sleep and death. In such cases, a violent inflammation takes place in the lungs and intestinal canal, which appears to be the proximate cause of death. It appeared, however, on the trial of Doctor Castaing, that this substance might be administered in such small doses as not to occasion this inflammation, and yet produce death, more particularly when its effects are modified by small doses of the acetat of Morphia, one ingredient of which is extracted from opium.

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* Dr. Thompson and other chemical writers state, that there is no azot in this substance; but by a later and more correct analysis of Messrs. Dumas and Pelletier, published in the Annales Phys. ch. for October 1823, it appears there is a considerable quantity of azot in this as well as all the other vegetable alkalies.

In the year 1817, M. Sertuerner, an apothecary at Eimbeck, in the kingdom of Hanover, published the result of his experiments on opium, which had occupied him for several years. He was the discoverer of Morphia. There are several ways of obtaining it, but the following seems the shortest and best:—Boil a concentrated solution of opium with a small quantity of magnesia (one grain of magnesia to forty-nine of opium is sufficient,) for a quarter of an hour, when a copious grey precipitate falls down. Separate this by the filter, wash it in cold water, and then macerate it for some time in weak alcohol, which is warmed, but not allowed to boil. By this means, the colouring matter is separated, and what remains is to be washed with cold alcohol. It is then to be dissolved by continued boiling in concentrated alcohol; the boiling liquid is then to be filtered, and on cooling, it deposits Morphia in crystals nearly free from colour. Thus obtained, the substance is transparent and colourless, with a very bitter and astringent taste, having nearly the same effect on the animal economy as opium. It acts more when in a state of solution than when in a solid state. Acids neutralize it, whence Chemists call it an alkali; and this property of acids makes them, particularly vinegar, the best means of counteracting its poisonous effects.

When we began this article, we had some expectation that we should have some curious experiments recently made on the acetat of morphia to communicate to our readers; but having been disappointed in getting access to the foreign Journal in which we have been informed they are contained, we must postpone them till our next Number.

AN ALCHYMIST'S TRICK.

The best delusion ever practised by the Alchymists, says Voltaire, was that which a Rosicrucian played, towards 1620, on Henry I. Duke of Bouillon, of the house of Turenne, reigning Prince of Sedan. "You do not possess," said the flattering charlatan, "a sovereignty worthy of your great qualities; and it is in my power to make you richer than the Emperor. I can only remain, however, two days in your territories, for I am obliged to go to Venice, to attend a grand meeting of the brethren; if, therefore, I confer wealth on you, you must keep my secret. Send to the chief apothecary of the city, and purchase some sugar of lead; throw in a single grain of the red powder which I will give you, and put the whole into a vessel over the fire, and in less than a quarter of an hour it will be converted to gold." He performed the operation, and repeated it three times in the presence of the Rosicrucian, who had previously purchased all the sugar of lead which was in Sedan, and had resold it, mixed with some gold. On quitting Sedan, he made the Duke a present of all his transmuting powder; who, having obtained a small quantity of gold in his experiments, did not doubt that, with the three hundred grains of powder, he should gain three hundred ounces of gold. He began to reckon his wealth; and calculated, that within a week he should gain thirty-seven thousand pounds, without thinking of what he might afterwards gain. The philosopher, however, was in haste to depart. He had given all his treasure to the Prince, and only wanted a small sum of the current money of the country to carry him to Venice, where he was to be present at the meeting of the *Hermetic* States. He was very moderate in his desires, and travelled without spending much money. He only asked 20,000 crowns to defray the expense of his journey to Venice: the Duke was ashamed that a man who had given him so much should receive so small a sum, and gave him 40,000. He soon afterwards consumed all the sugar of lead in Sedan, and then he made no more gold. The adept returned no more, having made a very good bargain, in getting 40,000 crowns for about three ounces of gold

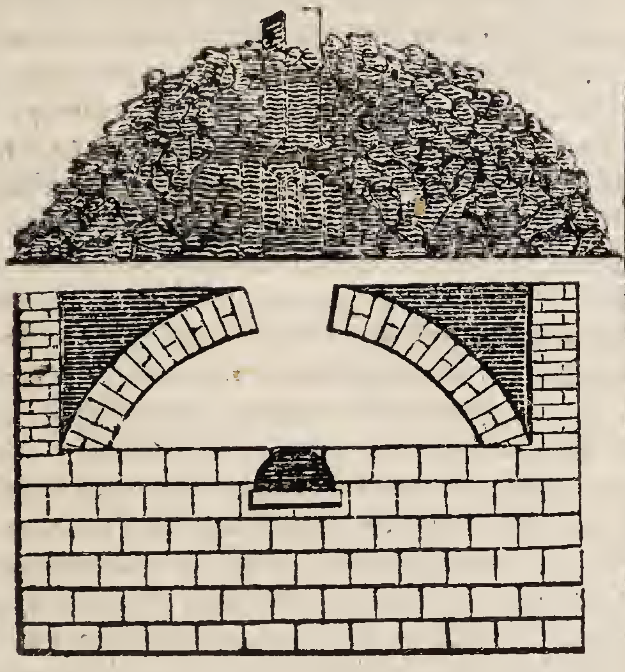
METHOD OF MAKING COKE.

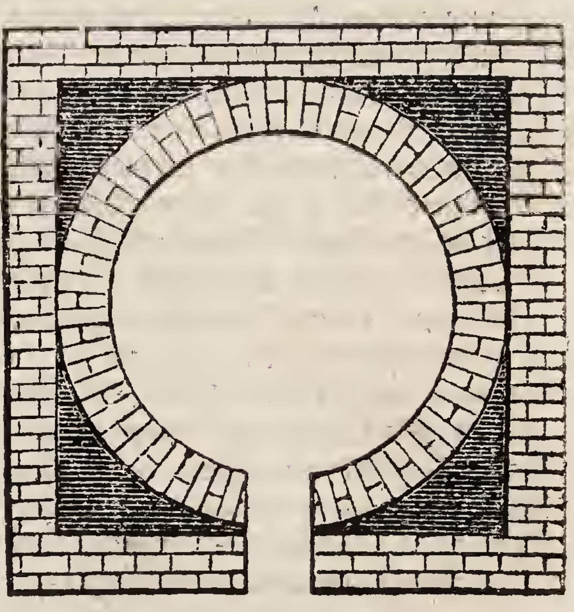
Coke, which is made by burning coal in a particular manner, is at present very extensively employed in various manufactures and arts. It now supplies the place of charcoal, which was formerly used in making iron from the ores of that metal. It is used to dry malt, to smelt metals, to refine gold and silver, and to make fires for many operations, to which the bituminous and sulphurous parts of the coal would be injurious. In fact, coke consists of the more pure and carbonaceous matter of the coal, while the sulphurous portion, which would give a taint to the malt and brittleness to the metals, and which is very often extremely injurious to workmen, is dissipated by the previous action of the fire. Within these few years, in consequence of the great demand for this article, considerable attention has been paid to selecting the coal best adapted to make coke, and to the best means of making it. The most general method of making coke was by burning coals in a heap, similar to the mode of making charcoal. A hearth was prepared, by beating the earth into a firm, flat surface, covering it over with clay. The pieces of coal were then piled up, inclining towards one another, and those pieces underneath were so placed as to rest on the ground with the least possible surface. The piles were made from 30 to 50 inches high, from nine to 16 feet broad, and contained from 40 to 100 tons of coals. A number of vents were left, reaching from top to bottom, into which the burning fuel was thrown, and the vents were then closed by small pieces of coal beat firmly into the holes. The kindled fire was thus forced to creep along the bottom, and when that from all the vents was united, it burst out on every side. If the coal contained pyrites —sulphat of iron—the combustion was allowed to continue a considerable time after the flame had burst out in all parts, and the smoke had disappeared, in order to extricate the sulphur completely, part of which is usually formed on the surface. If the coal contained no pyrites, the fire was covered up soon after the smoke disappeared, beginning at the bottom, and proceeding gradually to the top. In the course of 50 or 60 hours the heap is entirely covered with the ashes of char, formerly made; and in 12 or 14 days the coke may be removed for use. Treated in this way, a ton of coals produces from 700 to 1100 pounds of coke.

The success of this method depended on the pieces of coal being sufficiently large to allow of the passage of air in places; and, of course, small coal could not in this way be converted into coke, and was very often thrown away. To burn small coal into coke, however, an oven is now in use in various parts of England; and we here present our readers with a representation of the ground plan and front elevation of such an oven. It is a circular building, 10 feet in diameter within, and the floor, which is raised three feet above the ground, for the convenience of placing a low carriage under the door-way, to receive the coke as it is raked from the oven, is laid with common bricks set edgeways. The wall of the oven rises 19 inches above the floor, and a brick arch is then turned, rising three feet five inches more, and forming a figure closely resembling a cone, the base of which is 10 feet, and the apex is two feet, if measured within. The whole height of the building, from the floor, is five feet, and the wall, 18 inches thick, is built with good bricks, and closely laid, so that no air may get in through any part of the work. Around the whole a strong wall is built, as high as the oven, forming a complete square. The space between this wall and the oven is filled up with rubbish, well rammed down, to give solidity to the whole, and totally exclude atmospheric air.

The mode of making coke in this sort of oven is as follows:—Small refuse coal is thrown in at the opening at the top, till the oven is

filled up to the springing of the arch; the coal is then levelled with an iron rake, and the door built up with loose bricks. In two or three hours the fire is so violent that it is necessary to check the admission of air; and the doorway, except the upper row of bricks, is plastered up with wet sand and clay. When the charge has been in the oven 24 hours, this row is also closed; and in 12 hours more, when the flame is gone, the chimney is also closed with a thick bed of sand and earth. The whole remains twelve hours cut off from all connexion with the air and then, the process being complete, the door-way is opened, and the coke raked out into wheelbarrows or low wagons. The whole takes up 48 hours, and as soon as it is finished the process is again begun. About two tons of coals are put in each time; and the coke thus produced is used in manufactures which require an intense and long continued heat. After the process has been once gone through, the heat of the oven is sufficient to set the fresh coal on fire, and then the work goes on, night and day, without any interruption, or any further expense of fuel.





The other Cut represents another mode of making coke. A substantial brick chimney is built on arches, in an open space, and the coal is piled round it. When the heap is made, a quantity of burning coal is thrown down the chimney, which falling through the arches, kindles the heap in its neighbourhood, and the fire spreads from the middle through the whole heap. When it is judged to be sufficiently burnt, the mass is broken up and quenched by water. The coke thus prepared is better than any other, and less of it is required to effect a given purpose, so that the saving of expense is considerable. In our cities, the coke most in use is that from which the gas for lighting the streets is obtained. In this case, as the object is not to make coke, but to extract as much gas as possible from the coal, the coke being a refuse, as it were, disposed of for what it will fetch, the coal is much more roasted than in the other, but is quite as good for many purposes.

HISTORY OF THE CHERRY.

Cerasus.

THIS beautiful fruit was procured and brought into Europe on occasion of the overthrow of Mithridates, King of Pontus, when he was driven from his dominions by Lucullus, the Roman general, who found the cherry-tree growing in Cerasus, a city of Pontus, (now called Theresoun, a maritime town in Asia, belonging to the Turks,) which his army destroyed, and whence this fruit derives its present name of Cherry. Lucullus, who was as great an admirer of nature as of the arts, thought this tree of so much importance, that

when he was granted a triumph, it was placed in the most conspicuous situation among the royal treasures which he obtained from the sacking of the capital of Armenia; and we doubt much, if a more valuable acquisition was made by Rome during that war, which is stated by Plutarch to have cost the Armenians 155,000 men. We may very justly style it the fruit of the Mithdridatic war.

Botany seems to have been more studied in early times by distinguished persons than at present. In this instance we find the conqueror and the conquered both botanists. Mithridates, whom Cicero considered the greatest monarch that ever sat on a throne, and who had vanquished twenty-four nations, whose different languages he had learnt, and spoke with the same ease and fluency as his own, found time to write a treatise on botany in the Greek language.

It was in the 68th year before Christ that Lucullus planted the cherry-tree in Italy, which "was so well stocked," says Pliny, "that in less than 26 years after, other lands had cherries, even as far as Britain, beyond the ocean." This would make their introduction into England as early as the forty-second year before Christ, although they are generally stated not to have been brought to this country until the early part of the reign of Nero, A.D. 55.

Pliny mentions eight kinds of cherries, which were cultivated in Italy, when he wrote his Natural History, in the seventieth year, A.D. "The reddest cherries," he says, "are called *apronia;* the blackest *actia;* the Cæcilian are round; the Julian cherries have a pleasant taste, but are so tender, that they must be eaten when gathered, for they will not endure carriage." The *duracine* cherries were esteemed the best, but in Picardy the Portugal cherries were most admired. The Macedonian cherries grew on dwarf trees; and one kind is mentioned by the above author, which never appeared ripe, having a hue between red, green, and black. He mentions a cherry that was, in his time, grafted on a bay-tree stock, which circumstance gave it the name of laurea: this cherry is described as having an agreeable bitterness. "The cherry-tree could never be made to grow in Egypt, with all the care and attention of man."

The county of Kent has long been famous for the quantity of cherries which it produces; and, in all probability, they were first planted in this part of England, of which Cæsar speaks more favourably than of any other part which he visited. Some authors assure us, that the whole race of cherries that had been brought to this country by the Romans, were lost in the Saxon period, and were only restored by Richard Harris, fruiterer to Henry the Eighth, who brought them from Flanders, and planted them at Sittingbourn in Kent. This appears to be an error, as Gerard says, "The Flanders cherrie-tree differeth not from our English cherrie-tree in stature or in forme."

The Kentish cherry is considered to be the original kind, and it is also thought the most wholesome. Great quantities of this variety of the cherry are cultivated at Paris, where they are generally preferred, particularly the variety with the short stalk, called Montmorency, from the fertile and delightful valley of that name, in the vicinity of Paris. It is a curious circumstance, that, in England, fruit should, in general, be considered as a luxury, while, in most of the other countries of Europe, it forms a large part of the food of the people. This is particularly the case with the French, Germans, and Italians; and an Englishman, who has not visited foreign countries, finds it difficult to conceive in what an abundant manner the markets of the Continent are supplied with fruit. Paris is particularly well supplied, and the fruits which grow in the neighbourhood of Montmorency, have a high reputation from their superior flavour.

Mr. T. A. Knight has raised a

new variety of this fruit, called after him, *Knight's early black cherry*, and which seems to possess a very desirable property, that of ripening considerably earlier than the May-duke: it is of a fine dark hue, and its flesh is firm and juicy. It blossoms much earlier than any other sort.

There is an account of a cherry orchard of thirty-two acres in Kent, which, in the year 1540, produced fruit that sold in those early days for 1000*l.*, which seems an enormous sum, as at that period good land is stated to have let at one shilling per acre. We can only reconcile our minds to this great price, from the deficiency of other fruits in this country, and the splendour in which Henry VIII. and his ministers lived. Evelyn tells us that, in his time, an acre planted with cherries, a hundred miles from London, had been let at ten pounds.

Fruit orchards are still considered the most valuable estates in Kent, and cherry gardens, while in full bearing, pay better than orchards; but the cherry-tree does not generally continue more than thirty years in perfection. A single tree produces fruit that sometimes sells for above five pounds per annum for seven years in succession.

Luke Warde's cherry is so called because he was the first that brought the same out of Italy. The Naples cherry was first brought into our country from Naples: the fruit is very large, sharp pointed, somewhat like a man's heart in shape, of a pleasant taste, and of a deep blackish colour when it is ripe.

The cherry seems to have been a fruit highly esteemed by the Court, in the time of Charles the First, as we find by the survey and valuation of the manor and mansion belonging to his Queen, Henrietta Maria, at Wimbledon, in Surrey, which was made in 1649. There were upwards of two hundred cherry-trees in those gardens.

The cherry, like many other kinds of fruit, has had its sorts so multiplied, by various graftings and sowing the seeds, that we now enjoy a great variety of this agreeable fruit, and for a considerable portion of the summer, as it is one of the first trees that yields its fruit in return for the care of the gardener. From the ripening of the Kentish and the May-duke to that of the yellow Spanish and the Morello, we may reckon full one-third of the year that our tables are furnished with this ornamental fruit; and to those who have the advantage of housed trees, the cherry makes a much earlier appearance, as it is a fruit that will bear forcing exceedingly well.

Dried cherries are much esteemed for winter puddings; and the wine made from this fruit much resembles the red Constantia, both in colour and flavour. The small black cherries, with good brandy, produce one of the most wholesome as well as agreeable *liqueurs*. *Eau de cerises* is an admired *liqueur* in France.

The wood of the cherry tree, which is hard and tough, comes next to oak for strength, and near mahogany in appearance: it is in much request with the turners, for making chairs, &c., and is highly esteemed by musical instrument makers, who pretend that it is sonorous.

The common black cherry tree prospers in a cold soil, and affords considerable timber; and Evelyn mentions some that were 80 feet in length. In all probability these trees originally sprang from the cultivated cherry that had been introduced by the Romans, as they do not partake of the character of any of our native trees.

It is observed of stone fruit in general, that if sown immediately after they are excarnated, they will appear the following spring, but if kept too long, they will not germinate under two years.

The timber of the wild cherry-tree comes to perfection in about 40 years.

Judiciously planted, the cherry-tree is very ornamental in a shrubbery; its early white blossoms con-

trasting with the sombre shades of evergreens in the spring, and its graceful ruby balls giving a pleasing variety in the summer; particularly the morello, which, when planted as a standard, decorates the pleasure-ground by its gracefully pendant boughs, whose snowy blossoms, opening early to receive the sedulous bee, gives a pleasure that is scarcely surpassed by its autumnal transparent fruit.

There is a feast celebrated at Naumburg, called the "Feast of Cherries," in which troops of children parade the streets with green boughs, decorated with cherries, to commemorate a triumph obtained in the following manner:—In 1432 the Hussites threatened the city of Naumburg with immediate destruction, when one of the citizens, named Wolf, proposed that all the children in the city, from seven to fourteen years of age, should be clad in mourning, and sent as supplicants to the enemy. Proupius Nasus, chief of the Hussites, was so touched with this spectacle, that he received the young supplicants, regaled them with cherries and other fruits, and promised them to spare the city. The children returned crowned with leaves, holding cherries, and crying "Victory."
—*Phillips's History of Fruits.*

GINGER. AMOMUM ZINZIBER.

This plant has something of the habit of a grass in its appearance, and it grows to the height of two and sometimes three feet: it is a native of the East Indies, and is extensively cultivated in the West Indies, where it is planted in March or April, flowers about September, and when the stalks have withered about the end of the year, the roots are dug up in January and February following.

The roots of ginger, on account of which it is cultivated, furnish a well known and excellent spice. Two kinds are met with in commerce, the black and the white ginger. They are roots of the same plant, and differ only in the selection and mode of curing. The larger roots are chosen for the white ginger; and each root being washed and scraped separately, is dried in the sun. The whole of the remaining roots of the crop, after being picked and cleaned, are put into baskets dipped into boiling water, and after being scalded, are dried on a platform, and put up in bags for the market, under the name of black ginger.

The young roots of ginger constitute one of the most delicious preserves. When intended for this purpose, the roots are dug up while they are tender and full of sap, carefully picked and washed, and, after being scraped and peeled, they are put into jars, and covered with syrup, which is sometimes shifted two or three times.

CHEMISTRY AS A SCIENCE.
Art. II.
SIMPLE SUBSTANCES.

In our first paper on this subject, we merely defined the object of chemical science, and pointed out the principle on which we should proceed in treating of it. According to that principle, we have now to enumerate the substances which are at present considered by Chemists, from never having been decomposed, as simple substances; we shall then proceed to describe how each is obtained, and its properties. In our list of simple substances, we shall not include either heat, light, electricity, or magnetism, because the term substance conveys to ordinary readers an idea of something which they can either see or feel, and that thing which they see or feel has, at the same time, some weight, and offers some resistance; and neither heat, light, electricity, or magnetism, has any claim, in this point of view, to the character of a substance. We can see no good reason why the wind should not be so named, if the general terms above mentioned, and which are very properly appropriated to certain classes of facts, be called substances. We shall include, therefore, in our enumeration of simple substances, only such as are pon-

derable, and may be either seen or felt.

There is a celebrated system of Chemistry, French in its origin, not at present so much in vogue as it was, in which all substances are classed with a reference to their combustible or burning properties; and though the whole theory of combustion, and every thing which regards heat, is of the utmost consequence in Chemistry, it is, as yet, so imperfectly known, as to be a very improper basis for a theory of chemical classification.

All classification proceeds on some principle of resemblance between the bodies classed together, and of difference between them and the bodies from which they are separated in our classifications; and, undoubtedly, if there were a set of bodies which exclusively united with oxygen, giving out light and heat as the union was going on, this would be a reason for classing them separate from other bodies: but it is found, that bodies give out light and heat without uniting with oxygen, or burn when, as far as we know, no oxygen gas is present. This is quite a sufficient reason for rejecting this as the basis of a chemical classification. The phenomena of Chemistry are all reducible to two, the combination and separation of substances; and it is probable, that the most correct principle of classification would be the degrees in which substances combine or separate from one another, or what, in the language of Chemistry, is called, their affinity for one another. At present, this is made a subordinate principle of classification; we think it ought to be the leading principle. These degrees are not, however, yet sufficiently well ascertained with regard to all substances, to permit us to adopt the principle in essays like these; and we shall proceed on the more obvious one of resemblance in some chemical properties. There exists among Chemists, and, perhaps, among all mankind, a sort of opinion or prejudice, derived, probably, from the ancient doctrine of the four elements, or the still more ancient theory of two principles having combined to form, and then disputing for the mastery of the world; that the simple substances, of which it is, with all its beauteous imagery, composed, must be few, and have directly opposite qualities. So strong, indeed, is this prejudice, that the very first Chemist of the age, on a supposition that he had discovered azot to be a compound, ventured, not many years ago, to throw out a hint, and almost to frame a theory on it, that there were only two simple substances in nature possessing opposite properties. Perhaps such an opinion may turn out to be correct; at least there is a tendency in mankind to imagine, that the operations of nature are all carried on by some very few and simple principles, but at present we have no reason to believe that these principles have been discovered; and the earliest theoretical Chemists, who would never hear of there being more than four elementary substances, would be astonished could they learn that, notwithstanding our possession of more powerful instruments of analysis than they possessed, the moderns are obliged to admit the separate existence of fifty-two simple undecompounded substances.

Of these fifty-two substances, four closely resemble each other, in possessing an intense affinity or disposition to unite with other simple substances; and they differ from them in the following remarkable property: whenever a compound, consisting of one of them and one of the other simple substances, is submitted to the action of galvanism, the compound is decomposed, and these substances are evolved at the positive or vitreo-electric pole, while the others are evolved at the negative or resino-electric pole. This property, therefore, leads us to form one great division of the simple substances, into those which are evolved at the positive, and those which are evolved at the negative pole of the galvanic battery. Of

the remaining forty-eight, forty-two possess metallic, and six non-metallic properties. The latter are either gases or solids; and the solids are fusible or infusible. The remaining forty-two seem scarcely to admit of any accurate classification; and we shall put them down accordingly as they form, by their union with oxygen, alkalies, earths, or acids. These remarks are to be the ground of our classification; and we shall now give our readers a list of the simple substances at present known to Chemists under these heads.

The simple substances which are evolved at the positive pole of the galvanic battery, are—

a Oxygen
b Chlorine
c Iodine
d Fluorine. The existence of a separate substance of this name is, however, not yet proved.

The simple substances evolved at the negative pole of the galvanic battery, are—

Gases—Hydrogen
Azot
Infusible solids—Carbon
Boron
Fusible solids—Sulphur
Phosphorus

Metals, forming alkalies, by their union with oxygen:—

Potassium
Sodium
Lithium
Calcium
Barium
Strontium

Metals, forming earthy and not acid substances, by their union with oxygen.

Magnesium
Yttrium
Glucinium
Aluminum
Silicon
Zirconium
Thorinum
Iron
Nickel
Cobalt
Manganese
Cerium
Uranium
Zinc
Cadmium
Lead
Tin
Copper
Bismuth
Mercury
Silver
Gold
Platinum
Palladium
Rhodium
Iridium

Metals, forming acid substances, by their union with oxygen:—

Arsenic
Antimony
Chromium
Molybdenum
Tungsten
Tellurim
Columbium
Titanium
Selenium
Osmium

In our next Article we shall begin to give a brief description of each of these substances.

ANALYSIS OF SCIENTIFIC JOURNALS.

Art. I.

THE TECHNICAL REPOSITORY FOR MARCH 1824.

The Editor of this Periodical seems to us an industrious collector, or a great gatherer of other men's scraps; and his Repository, like that of Tattersall's for horses, and the Bazar for ladies' work, only takes in for show the goods of others. We have no quarrel with Mr. Gill, however, on this account, nor indeed on any account, we only mean to describe the character of his work in as few words as possible, and shall occasionally profit by the convenience his public stores offer of borrowing at second-hand. The first article in his present Number, is a continuation of a paper on the manufacture of *Ceruse* in France; and as it contains all which the cunning Frenchman, its author, chooses to divulge of the mysterious process now practised at Pontoise by Messrs. Brechon and Leseron, for making white-lead, we did intend to extract it; but on closely examining the article, we found it so *rigmarole*, and, we must say, so unintelligible and indistinct, that we were obliged to abstain, and have only to recommend Mr. Gill to employ his pen or his scissors so that his future literary larcenies may be at least of some utility. The next article hung up in the Repository to attract customers, is a

very sensible description, taken from the Transactions of the Society of Arts, by a Mr. Denovan, of his mode of curing herrings; and we should have deemed its insertion by Mr. Gill a proof of good taste, did it not happen that the subject has recently been discussed in one of those weekly publications which the "Chairman to the Committee of the Mechanics, in the Society for the encouragement of Arts, Manufactures, and Commerce," &c. &c. has the air of openly despising in his Repository; and therefore we are led to suspect he is only endeavouring to catch surreptitiously a portion of that interest which now belongs to the subject from the labours of our cotemporary. We highly approve, however, of Mr. Denovan's exertions in this cause, and only wish, instead of trying to mend the fortunes of the state, he would bend his exertions so to improve his own, that claiming the honours which the Society of Arts can bestow, he might have no occasion to solicit its bounties and pecuniary rewards. If he cannot make money by his mode of curing herrings, how can other men? and a commerce which brings no profit to the trader, cannot be supposed, however extended, to be a national benefit. The only original article we observe in the present Number of the Repository, is a letter from a correspondent, correcting an error of the very worthy Chairman-editor; and the only article we can quote, is a paper on fertilizing filbert trees, taken from the fifth volume of the London Horticultural Society. This communication is in substance as follows:—

ON THE FERTILIZATION OF THE FEMALE BLOSSOMS OF FILBERTS.

The Rev. Mr. Swayne, the author of this paper, sets out by observing, that the flowers of a male palm-tree were carried from Leipsic to Berlin, a distance of twenty (he means German, making about sixty English) miles, and there suspended over the branches of a female tree of the same species, and they caused the latter to yield, in the first year of the experiment, above one hundred ripe fruit; and, on repeating it the second year, two thousand, though the tree had, for 30 years preceding, regularly blossomed, without ever perfecting the fruit. From this fact, Mr. Swayne concluded, that by taking the male flowers of the wild hazel, and suspending them over filbert-trees, the produce of the latter might be rendered more abundant. He acted on this suggestion. He had two filbert-trees which had never borne much fruit, because, as he supposed, there was a deficiency of male blossoms; and he immediately proceeded in quest of some. After a short search, he found on a hazel-bush a few sprigs of catkins just beginning to open. He carefully gathered and suspended them on the upper and windward part of his filbert-trees. In his walks afterwards, he was careful to repeat the same operation; and though a severe frost intervened, which killed and scorched up all the catkins of the hazel, his two filbert-trees produced him two pounds of filberts, which is more, he says, than Mr. Williamson, who has written a paper on filberts, allows for the produce of filbert-trees in Kent. Finding this plan succeed so well with his trees, he recommended the wife of a neighbouring farmer to try the experiment, who was overjoyed to learn she could make her filbert-trees fruitful by so easy a process. The reverend gentleman, after detailing some more experiments of the same kind, followed by similar success, enters into a discussion of the propriety of pruning filbert-trees so closely as is done in some parts of Kent; and thinks they would be more fruitful if they were not to be despoiled of their golden honours. He attributes the failure of the filbert crops, which is said to take place three years out of five, to a deficiency either in the number or the power of the male blossoms; and of course recommends the owners of filbert planta-

tions to prune less, and when they observe a deficiency of this kind, to endeavour to supply it by the catkins of the hazel-bushes.

(*To be continued.*)

LEVEL OF THE BALTIC.

It has long been a matter of doubt, whether the level of this sea sinks or not; and to decide this question, some learned men, under the auspices of the Emperor of Russia and of the King of Sweden, have lately commenced a series of observations. Of course the alteration, if any, takes place so gradually, that some time will be required before the point can be ascertained; but if the observations are carefully made, they may clear up several doubtful matters.

EASY METHOD OF BREAKING GLASS IN ANY DIRECTION.

Dip a piece of worsted thread into spirit of turpentine, and put it round the glass in the direction you require it to be broken; then set fire to the thread, and the glass will break in the direction of the thread; or apply a red hot small wire round the glass, and it it does not crack immediately, throw cold water on it, and the desired effect will be accomplished. This is a very useful method for Chemists, for broken glasses may, by this means, be rendered serviceable in the laboratory. The explanation of this is as follows:—By the application of heat to glass, as to other bodies, the part heated expands; and as glass transmits heat but slowly, the parts to which heat is applied expand faster than the other parts, and thus separate from them, or the glass cracks. In domestic economy, a knowledge of this simple fact is of considerable importance, as tumblers, jugs, and a variety of earthenware and glass vessels, are broken by the sudden application of heat or cold.

TO CORRESPONDENTS.

In answer to an Inquiring Amateur, we have to say, that it is our intention to describe the most familiar and useful part of chemical apparatus. As to where it may be got cheapest, we must ourselves invite communications from those numerous persons who deal in it, or who use it, for we cannot boast of the reasonable terms on which our own instruments are procured.

The commencement of a Description of Bleaching, *which will be followed by a series of Essays on the useful Chemical Arts, in our next.*

We feel great pleasure in complying with the request of our friend, a Chemist. He will find what he asks for at our Publishers', and which, we are glad to observe, had been left there for him before we received his communication. His Paper on a new Invention for procuring Instantaneous Light will appear in our next, if the Plate can be got ready.

Blowpipe may as well cease his puffing—he will not melt us.

We beg leave to recommend our correspondent Retort, *to add the word* Splenetic *to his signature in future; as he can have no claim to sign himself* Retort Courteous.

*** Communications (post-paid) to be addressed to the Editor, at the Publishers'.

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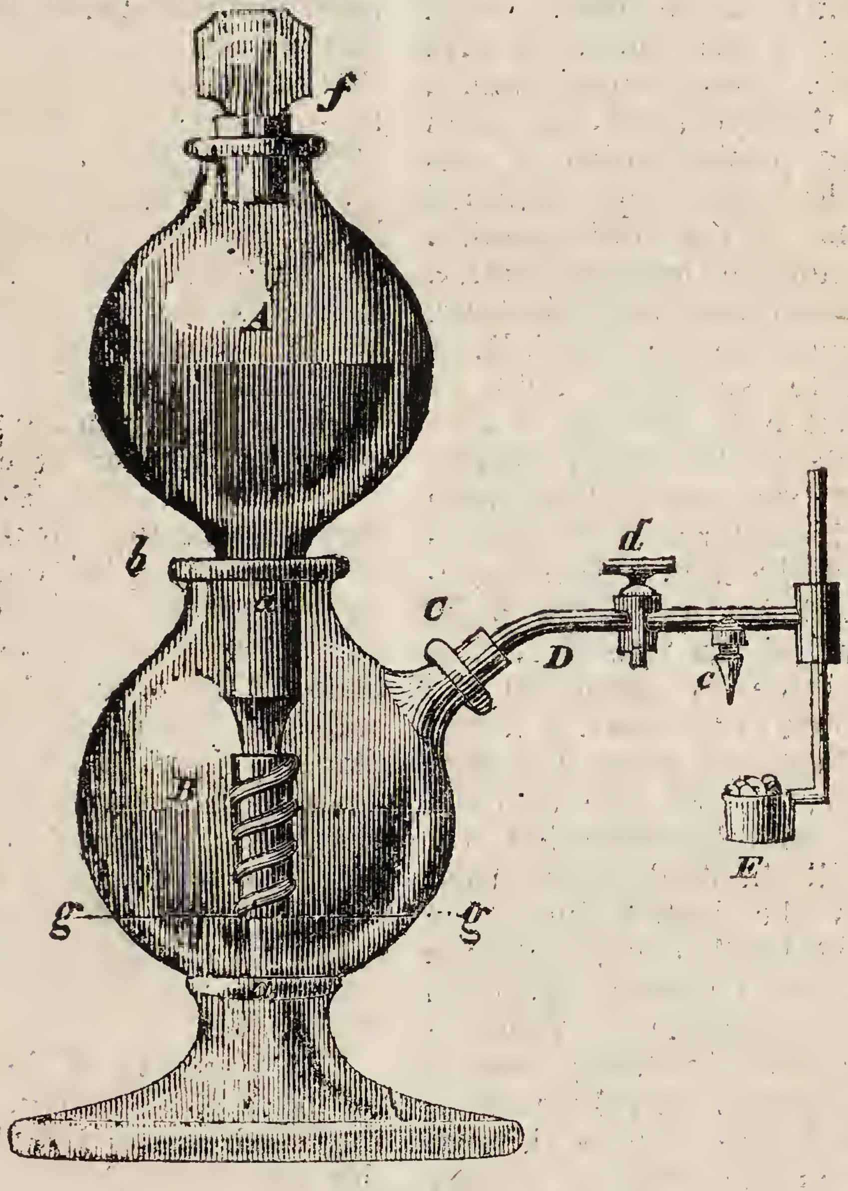
B. Bensley, Bolt-court, Fleet-street, London.

The Chemist.

"—— Search, undismayed, the dark profound
Where nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. III.] SATURDAY, MARCH 27, 1824. [Price 3*d*



CONTENTS.

INSTANTANEOUS LIGHT.

(FROM A CORRESPONDENT.)

THE following method for procuring instantaneous light, is founded on the lately discovered property possessed by platinum, of becoming red hot when a stream of hydrogen gas is directed upon it. It was exhibited by Mr. R. Phillips, in his Lecture, at the London Institution: and he remarked, that it was curious, both as a philoso-

phical experiment, and as an elegant mode of procuring immediate light.

A and B are two glass vessels of a spherical figure; A has a hollow tube proceeding from it, *a a*, the upper part of which fits, air tight, into the neck, *b*, of the other vessel, B; its lower orifice reaches near the bottom of the vessel, B. This tube is encompassed by a plate of zinc, as is seen in the plate. C is a neck from the lower vessel, which joins a brass tube, D, with a stop-cock, *d*, and a small pipe, *c*, to direct the hydrogen gas upon the spongy platina which is contained in the copper box, E, joined to the tube of the sliding rod, *e*. To use it, remove the top vessel, A, fix the plate of zinc round the tube, *a a*, and pour into the vessel, B, as much dilute sulphuric acid as nearly fills it to the opening, *b*, after which replace the upper vessel; in this state the acid will act upon the zinc, the water will be decomposed, and the hydrogen being liberated, will rise in bubbles to the upper part of the vessel, B, but not being able to escape at the ground fitting of the part, *b*, it will press the fluid, and cause it to pass up the tube, *a a*, and rise into the vessel, A; and this operation will continue till the fluid is depressed as low as the dotted line, *g*, at which point it will no more act upon the zinc, and no more hydrogen gas will be produced. When a light is required, nothing more is necessary than to turn the cock, *d*, and allow the gas to blow through the pipe on the mass of spongy platina in the box, E, which will become red-hot, and a match may at once be lighted by it; *f* is the ground stopper of the upper bottle. The whole apparatus is perfectly free from danger, and forms one of the best and most elegant modes of producing instantaneous light.

BLEACHING.

Art. I.

HISTORY OF BLEACHING.

Bleaching is altogether a chemical process, and has been much improved in modern times by chemical discoveries. The great object is, to give the greatest possible degree of whiteness and softness to the different substances of which our garments are made, without injuring their texture. To do this in the best and cheapest manner, it is necessary to know what causes the dark colours of the substances to be bleached, and what substances will act on these colours without acting on the material. It must not be supposed, however, that this art has no other advantage but that of giving a brighter appearance to our clothes. This, though it affords all people a considerable pleasure, is not the only, and, perhaps, not the greatest advantage of bleaching. The dirt, by which garments are rendered unhealthy, is more easily detected in white clothes than in clothes of any other colour. It is also known, that the colouring matter of most of the substances used for clothing is not favourable either to the durability of the stuff, or its health preserving properties; and that at least a moderate bleaching is necessary to make it last long and promote our comfort. We do not say, however, that all these effects of bleaching were known ever since it has been practised; they probably were not, as in its origin, like most of the arts, it was entirely empirical, and practised chiefly on account of the beautiful appearance it imparted to clothing.

The discovery of the most general mode of bleaching, that of wetting cloth exposed to the action of the sun, must have been coeval with the employment of hemp or flax as a material for dress; for it cannot be washed and dried in the sun without becoming sensibly whiter than it was before. Now we learn from sacred history, and the fact is confirmed by mummies brought from Egypt, that the use of fine linen prevailed in that country in the earliest ages of which any record is left. Abraham says to the King of Sodom, "I will not take from a thread of the woof." Rebecca, we are told, covered herself with a veil when she perceived

Isaac (Gen. xxiv. 65.); and Moses tells us that, in his time, the land of Egypt was employed for the growth of flax. (Exodus ix. 31.) A writer of great celebrity, M. Goguet, in his work on the Origin of Laws, says, that the inhabitants of Asia employed earths and alkaline plants in the operations of washing, the use of which continues, at the present time, to form one part of the process of bleaching. In the poems of Homer, the women are described as washing their linen garments and exposing them to the bleaching power of the sun. As early, at least, as 300 years before Christ, lime was employed in bleaching, as we learn from Theophrastus, who lived about that time; and who relates, that a vessel, loaded partly with linen and partly with lime for bleaching it, was burnt by water getting access to the lime. Pliny, an author who wrote in the first century, mentions white linen as being more valuable at Rome than any other. And as linen, at least under the process usually adopted to prepare it, is not naturally white, there is, in this circumstance, strong evidence that bleaching was carried to considerable perfection among the Romans. Indeed, in other parts of his works, he distinctly mentions the several alkaline earths the Romans employed in bleaching. He also says, that both the Gauls and Britons were acquainted with a method of bleaching linen, which he described as being effected by pounding the yarn in a mortar; and, when made into cloth, beating it on a smooth stone with broad-headed cudgels. He adds, it becomes whiter in proportion as it is beaten. It is, perhaps, not a little singular, that beating linen with broad sticks, on flat stones, by the side of a running stream, is, at this day, the mode of washing it through the greater part of Europe. There is, therefore, abundant evidence to prove that bleaching, both by mere exposure to the sun's rays, and by the use of alkaline substances, was practised in the most remote antiquity. It is here worthy of remark, that alkaline substances continue to be used to this day in bleaching; and it may almost be doubted, if any considerable improvement was made in the art of bleaching, from the time of the Romans till after the discovery of chlorine, or oxymuriatic gas, in 1774. The first introduction of this substance, as a means of bleaching linen and cotton, towards 1787, constitutes an era in the art, since when it has undergone a complete change. Chemistry has now done much to ascertain what are the colouring matters in the different species of natural productions of which clothing is made; and it is enabled, therefore, in a great measure, to prescribe what are the best means of getting rid of the colour without injuring the texture of the cloth.

Before the introduction of oxymuriatic gas, or chlorine, into the art of bleaching, Holland was celebrated throughout Europe for its bleaching grounds; linen was sent there from the farthest part of Germany, and from Scotland, to be bleached, and was then sold at a higher price than could be got for any other linen of an equal fineness. To this day *Holland* continues to enjoy a reputation; and cloth is sold in all our shops under this name, in consequence of no other country being formerly able to bleach so well. It had some manufactories of its own for linen; but the principal part of that which was exported was made in Silesia, which continues at this day to be the great manufactory for fine linen. So high was the reputation which Holland enjoyed for its bleaching grounds, that they were imitated all over Europe. The great superiority of the Irish linen is supposed to have been principally owing to the Dutch method of bleaching having been introduced into Ireland; and, not thirty years ago, it was thought that an individual conferred a great benefit on the country who established bleaching grounds after the Dutch fashion in the north of Germany. In

our next Article on this subject, we shall describe the method of bleaching which was followed in Holland and other parts of Europe, before the employment of oxy-muriatic acid for the purpose of whitening cloth.

ANALYSIS OF SCIENTIFIC JOURNALS.

Art. II.

ANNALS OF PHILOSOPHY FOR MARCH 1824.

This is a very different publication from the former; and, without costing more, contains a considerably larger quantity of letter-press, and much better articles. There is a due proportion of extracts from other works, analyses of books, proceedings of philosophical societies, &c. &c., and some original articles. The one on the Crystalline Forms of Artificial Salts, which stands first, we must pass by without further notice, as being only the end of a series of papers, and without any interest. Then comes "*Observations and Experiments on the daily variation of the Horizontal and Dipping Needles, under a reduced power, by Peter Barlow, Esq.,*" &c., abstracted from the Philosophical Transactions for 1823. This gentleman, who has already contributed so much to extend our knowledge of magnetism, communicated to the Royal Society, in 1823, the result of some of his experiments on the Daily Variation of the Horizontal and Dipping Needles. He thought, and justly thought, that this variation would become greater if the directive power of the needles was diminished. He therefore masked the terrestrial influence, and succeeded in producing, by that means, a much larger daily variation; but he failed, we think, in his hopes of ascertaining, by thus increasing the effect, the cause of this variation. Still, the results he obtained were somewhat curious. He concluded, for example, from the needle generally tending, in whatever direction it might be placed, to some spot between N. and N. N. W., that there is between these two directions a point where the variation is at zero. Mr. Barlow also observed a curious anomaly between the daily variation in-doors and in the open air; whence he was led to suppose that the solar light is the principal operating agent in producing the daily variation. The third article is "*On an improved Apparatus for the Analysis of Organic Products,*" borrowed from the Transactions of the Society for the Encouragement of Arts. As the analysis of animal products is at present pursued in various parts of Europe with great activity and some curious results, we shall take an early opportunity of laying this paper, with its accompanying plate, before our readers. At present, we must content ourselves with having referred to it. The fourth article is "*On the ancient Tin Trade,*" from which we learn that the writer differs from the Rev. T. Hodgson, in his notion that the Phœnicians had traded to Cornwall for Tin sixteen centuries before the time of Julius Cæsar. We willingly leave these antiquaries, learned in the lore of other times, to settle this point betwixt them. From the next article, "*On Fossil Shells,*" also borrowed from the Philosophical Transactions, we learn as little of what Nature was doing some forty or fifty centuries ago, as we learned from the former article of what the good people of Cornwall and the Phœnicians were about at a later period. The paper is, however, from a learned F.R.S., and of course must be of great value. We necessarily pass over article sixth, "*On the Active Power of Dilatation of the Heart, by D. Williams, M.D.;*" for the phenomena of life, though the living principle modifies chemical action, and though many of its results are obtained by chemical processes, are not to be wholly explained by chemical laws. The next article is for the adepts of chemistry, being a Table of Equivalent Numbers, drawn up by the Editor. It will be useful to Chemists, but admits neither of extract nor further description. We have then Astro-

nomical Observations, by that indefatigable friend of science, Col. Beaufoy. In article nine, G. Cumberland, Esq., gives his opinion as to the cause which has brought together the bones of various animals in caves; to account for which, we agree with him, will be a subject of some difficulty. We have then a *Table* of the Comparative Temperature of Penzance and Pisa, for one month, by Mr. Edward Giddy; and if this short period of observation entitled us to draw any inference, we might conclude that Cornwall was quite as warm in winter as this part of Italy, and subject to less sudden variations of temperature. The mean of the whole observations at the latter place was 39° 9′; at the former, 39° 8′; the greatest difference betwixt the mean of three observations, for any two days, was, at the latter, 21° 0′; at the former, 20° 6; the difference betwixt the lowest and highest temperature observed in the whole period at both places was in the same ratio; but the difference betwixt any two consecutive observations, amounted at Penzance only to 6° 1′, while at Pisa the difference was as much as 15° 7. Article eleven is an account, taken from the French, of the "*Volcanos at present in existence;*" in which it is stated that, with the exception of two in the central part of Asia, not one is more than 50 leagues from the sea: whence it is inferred that water acts an important part in volcanic eruptions. The following general summary is worth quoting.

Number of Active Volcanos.

	On the Continent.	In the Islands.	Total.
Europe	1	11	12
Africa	0	6	6
America	58	3	61
Asia	8	24	32
Oceania*	0	52	52
	67	96	163

We have then *An account of certain instruments* formerly used for blasting in the lead mines at Allenheads. Mr. Smith, F. R. S., afterwards proves, in a paper concerning *Jupiter's third and fourth Satellites*, that the opinion of its being of no use to make observations on these bodies, originates in prejudice and terminates in error. The ANNALS concludes with an analysis of books, in which we observe an account of some curious results obtained by Mr. Scoresby, as to magnetism. This gentleman has found that the magnetizing effects of percussion might be increased by hammering on the end of a steel bar, while its lower end rested on the upper end of a large rod of iron or soft steel. This effect was increased by hammering the wire or bar of steel between two bars of iron; and, treated in this way, the bars were speedily made so magnetic as to lift their own weight.

* Or the islands of the Pacific Ocean and South Sea.

AIR BEDS.

DREAMS, as all the world knows, are only phantoms of the brain; and it is likely they will be rendered more pleasing by sleeping on air beds. An ingenious mechanic, of Somersetshire, not long ago obtained a patent for stuffing a bed with air instead of feathers; and the following is the description of this new mode of obtaining light sleep:—"The invention consists in rendering the case of the bed, pillow, &c. impervious to air, and filling it, by means of an *air-pump*, (we presume a condensing syringe is here meant) with common atmospheric air, instead of down or feathers. The air is introduced through an aperture or tube into the case, and prevented from returning by means of an air-tight stop-cock or valve. The case may be rendered impervious to air by various methods; but that recommended by the patentee, is a composition of India rubber, spirits of turpentine, and linseed oil, which, when dry, is extremely pliable, and so elastic, that if the cloth be folded in sharp corners, it will not crack or peel off

"The advantages of this method of construction for beds and pillows, are their superior degree of

elasticity, affording the most refreshing and easy repose, either in this or even in the warmest climates; that they may, when required, be changed from the greatest degree of softness to the hardness of a mattress, by moving the handle of the air-pump, which is placed commodiously within reach; or may be rendered soft to any required degree, by the exhausting pump, also within reach.

"In addition to these conveniences, they may at any time be rendered perfectly fresh and cool, by merely changing the air, by the alternate use of the air-pumps; this may be effected in a few minutes, without the person sleeping on the beds being moved; hence their great advantage to invalids, and their generally refreshing and salubrious effects.

"Such machinery may at first sight appear too philosophical for common use, and too cumbrous for a sleeping-apartment: but as to the first point, only a very small portion of ingenuity is required to become conversant with their application; and as to the second, it is merely necessary to say, that the air pumps, together with all the machinery for filling and exhausting the beds, being inclosed under the bedsteads, and communicating with cords and tassels (resembling bell-pulls) suspended immediately above the pillows, any alteration in the state or temperature of the beds is thus easily effected at any time required.

"The fact is, that they save much manual labour, as they require no making up; for by their elasticity they rise immediately when left, and are then in the state of other beds after being shaken and made up, the counterpane, &c. being returned as usual: hence they occasion no dust or film in the rooms, or on the furniture, which is always the case where feather or down beds are used.

"For medical purposes also they may be filled with air at any required temperature; or with water, steam, or other fluids, wet or dry, elastic or non-elastic, to which the case is equally impermeable. In addition to which, they have several other advantages. They are not subject to be sloping on one side, nor to those hard clumps or knots which feathers or down gradually acquire in the course of a few years.

"They are likewise extremely light, the largest weighing only a few ounces, and portable also, being easily folded or rolled, after being previously exhausted."

THE ALCHYMISTS' LANGUAGE.

We have already given a little history of an Alchymist, and one of their tricks: the following may serve as a specimen of their Language:—Basil Valentine, of Erfurt in Germany, was one of the most celebrated of them, and was one of the first of those who introduced metallic preparations into medicine. He was of course an opponent of the physicians of the school of Galen, who were attached to the use of inert and simple medicines. In his book called the "Chariot of Antimony," he thus addresses his opponents:—"Ye wretched and pitiful medicasters, who, full of deceit, breathe I know not what Thrasonick brags; infamous men, more mad than Bacchanalian fools; who will neither learn nor dirty your hands with coals; you titular doctors, who write long scrolls of receipts; you apothecaries, who with your decoctions fill pots no less than those in princes' courts, in which meat is boiled for the sustenance of some hundreds of men;—you, I say, who have hitherto been blind, suffer a collyrium to be poured into your eyes, and permit me to anoint them with balsam, that this ignorance may fall from your sight, and that you may behold truth as in a clear glass." But though Valentine was such an enemy to simples, his own powerful medicines did not always succeed. It is said, that having thrown some antimony to the hogs, it purged them heartily, and that afterwards they grew very fat.

From this, he imagined that his brother monks, who had become lean by mortification and fasting, and long prayers, would also thrive on a dose of antimony; but Valentine was mistaken: instead of fattening they died, and the medicine which agreed so well with hogs was called *Anti-moine*, from killing monks.

VEGETABLE ALKALIES.

From the *Annales de Phys. Ch.* for October 1823.

The vegetable alkalies, a whole class of bodies, which have been discovered within a very few years, are worthy of the attention of Chemists. Only a few experiments have been, before the present time, made to ascertain their composition, by Messrs. Pelletier and Dumas; and they have now published analyses of each of them. They made use of the oxide of copper; and many precautions were necessary to obtaining correct results. The oxide was procured by the calcination of the nitrat: washed and heated again, it reddened, and was exposed heated to the action of hydrogen gas to destroy the oxide. The alkalies were heated to 212° *in vacuo*, when infusible, and when fusible were melted in the same circumstances. To produce combustion, the vegetable matter was put, with five times its weight of oxide and a little pounded glass, into a tube, which, by means of caoutchouc, was connected with another tube filled with muriat of lime, which, in its turn, communicated with another tube adapted to collect the gas. The operation was conducted with the usual precautions. The quantities of carbonic acid, of water, and of azot, were ascertained. In order to know the quantity of oxygen, the authors analysed a portion of their oxide by means of a very simple apparatus, consisting of a graduated tube, bent at right angles, having a stopcock at one end, and a ball at the other, in which the oxide was to be placed. The tube was filled with pure hydrogen, and, on being heated, the oxide took fire; the lower cock was then opened, and the height to which the water rose indicated the degree of absorption. Messrs. Pelletier and Dumas obtained *Quinina*, in a crystallized state, by melting it *in vacuo*, and allowing it to cool slowly. It absorbs from three to four hundredths of water when macerated in this fluid, and probably forms a hydrat. The sulphat of quinina becomes phosphorescent at 212°, and emits vitreous electricity. The nitrats of quinina and of cinchona, not before crystallized, were obtained in this state: the former crystallized in very short rhomboidal prisms, inclined to the base, and indivisible; the latter crystallized in rhomboidal prisms, perfectly rectangular, and divisible. All the vegetable alkalies contain azot, and several of them, as cinchona and caffein, contain a very considerable quantity. To discover small quantities of azot in vegetable substances, the authors made use of one of the two following methods:—The substance was distilled, and the product received in proto-nitrat of mercury, when, if ammonia was present, a precipitate takes place of a dark grey; or a portion of sugar and oxide of copper, above which some of the substance in which azot is looked for, was burnt in a tube: when the gas arising from the first mixture is pure carbonic acid, the second substance is set on fire, and thus the smallest quantity of azot becomes perceptible.*

REMARKABLE ALTERATION PRODUCED IN WOOD BY LIGHTNING.

In a letter sent from Greifswalde, of the 22d of November 1822, to Mr. Bergrath Lenz, the following circumstances are related:—In the year 1821, in the month of August,

* These results are confirmed by the experiments of Mr. Brande, published in the last Number of the Quarterly Journal of Science, &c., though that distinguished Chemist failed in his attempt to crystallize quinina.

the lightning set fire to a windmill, situated near Greifswalde, and damaged several of the arms of the mill. The miller, on going to repair his mill, found in the axletree an aperture in which he discovered 280 black balls, all of the same size: some which were found under similar circumstances, near Thoren, were considerably larger."—This letter was accompanied by one whole ball and a half one. The half ball was given to the writer of this notice for examination. It had the shape of an elliptical spheroid, the large axis of which is 18, and the small axis 17 parallel lines. Their substance is of a dark grey colour, and not porous, of a brittle texture, and containing small, hardly perceptible particles of wood. On the surface, it appeared flaky. In a chemical point of view, it appeared partly like brown coal, partly like burnt wood; for with ammonia, and still more easily with solution of potash in water, it may be dissolved into a dark brown fluid, with the exception of the particles of wood; and when exposed to a current of air, and sufficiently heated, burned at first with a flame, and afterwards glowing, by which process the usual products of burnt wood, namely, carbonic acid, water, and an alkaline ash were formed. The substance of these balls, therefore, is nothing but the wood of the axletree in which they were found, crushed, half burnt to cinders, melted, and at last formed into balls by the lightning. The circular form which they all had is undoubtedly the most remarkable circumstance of the whole event, and deserves the attention of natural philosophers.

IRON PIERCED BY SULPHUR.

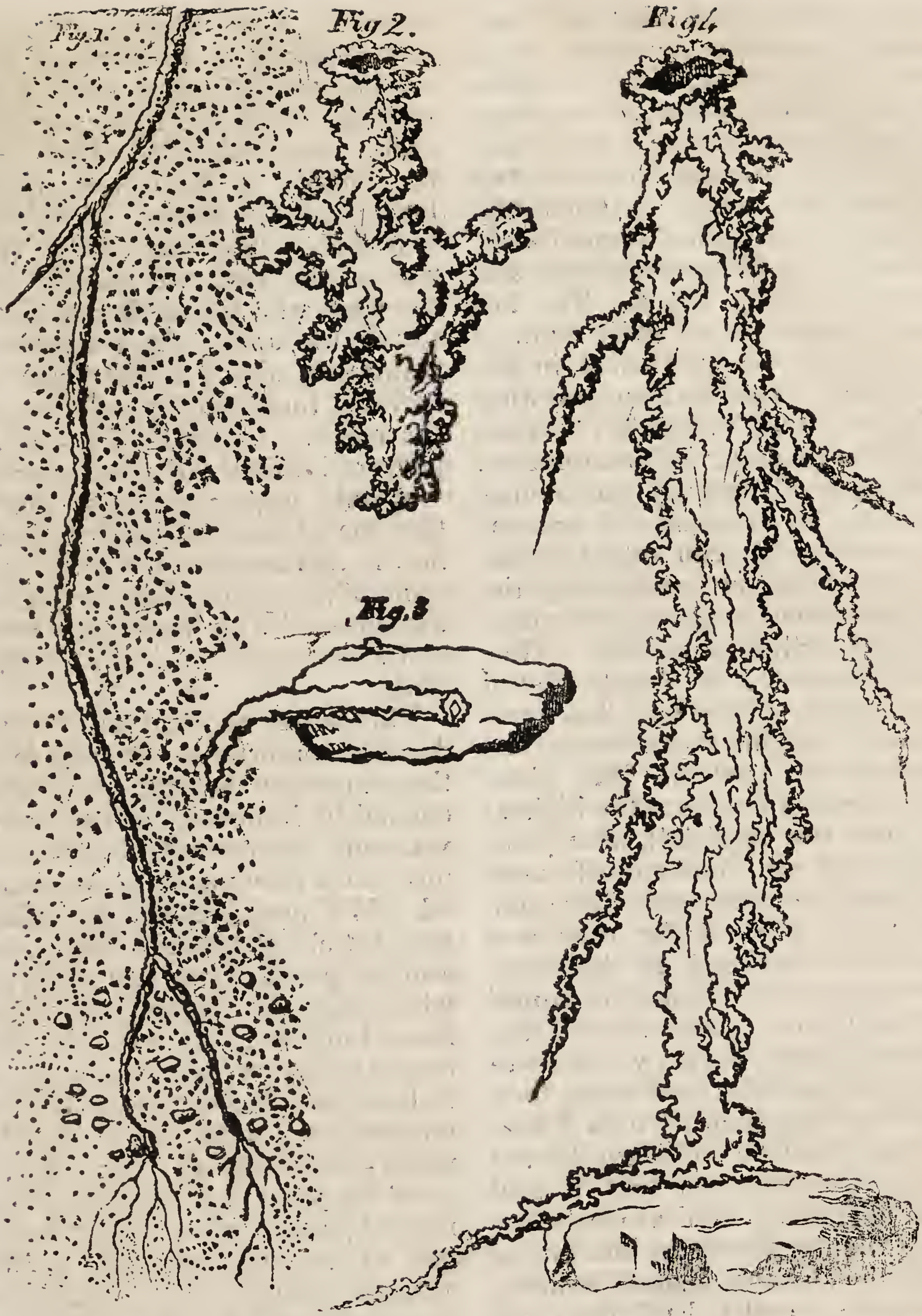
The following curious experiment is detailed in a letter from a Colonel Evain to M. Gay Lussac, and published in the *Annales de Chim. et Phy.* for Jan. 1824:—"I caused," he says, "a bar of forged iron, 18 lines thick, to be heated red hot; on being withdrawn from the fire, a rod of sulphur, seven lines in diameter, was applied to its surface; in fourteen seconds the sulphur made a hole, perfectly circular, quite through the iron. Another bar of iron, two inches two lines in thickness, was pierced in fifteen seconds. The holes in both were precisely of the form of the sulphur employed, but rather more regular on the side whence the sulphur issued than where it entered, the hole being here a little jagged. Steel in bars, made of old files, was pierced even quicker than the iron, and the holes were equally regular. Grey cast-iron, heated almost to melting, was not altered by the application of the sulphur to its surface, and was not even marked. I took a portion of this iron, shaped in the form of a crucible, and I put in it sulphur and iron; on applying heat to it the forged iron and sulphur speedily melted, but the grey cast-iron suffered no alteration.

UNIVERSAL CEMENT.

A Cement made in the following manner, will unite, it is said, either glass or porcelain, and either marble or metals:—

"To an ounce of mastic add as much highly rectified spirits of wine as will dissolve it. Soak an ounce of isinglass in water until quite soft, then dissolve it in pure rum or brandy, until it forms a strong glue, to which add about a quarter of an ounce of gum ammoniac, well rubbed and mixed. Put the two mixtures together in an earthen vessel over a gentle heat; when well united, the mixture may be put into a phial and kept well stopped.

"When wanted for use, the bottle must be set in warm water, when the china or glass articles must be also warmed, and the cement applied. It will be proper that the broken surfaces, when carefully fitted, shall be kept in close contact for twelve hours at least, until the cement is fully set; after which, the fracture will be found as secure as any part of the vessel, and scarcely perceptible."



VITREOUS SAND TUBES.—POWER OF LIGHTNING.

In 1812, E. L. Irton, Esq. of Irton Hall, Cumberland, transmitted to the Geological Society specimens and descriptions of some tubes found in the sand near Drigg, in Cumberland. Three were found, and the diameter of each was about an inch and a half. The spot was afterwards examined, and the substances subjected to a chemical examination, by some of the members of the Geological Society. From their examination and experiments, it resulted, that these *tubes* had been formed by the passage of the lightning or electric matter through the sand, which it melted or fused in its passage into the earth. These tubes were found to descend about thirty feet through the sand. The outside of the tube was coated with an agglutinated sand, which, when viewed with a lens, was found to consist of black and white grains mixed together, rounded by fusion. The sides of the tube were about the twentieth part of an inch thick, very hard and rigid, and the outside interrupted by deep furrows, like the bark of an elm-tree. (See Fig. 4.) On one spot in its descent, the electric fluid had met with a bed of pebbles of the size of

kidney beans; had dispersed and spread its fusing power, so as to form, not a tube, but a mass. (Fig. 3.) In one place, about three feet under the surface, it had made an attempt to pass between two large pebbles, which flattened and lessened the tube; and immediately below this it became crooked and contorted, as in Fig. 2. The following accounts of some similar discoveries were published in the *Annalen der Physik* for June and July 1823:—"I was," says Dr. Charles Gustavus Fiedler, "in Stampfen, on the borders of Hungary; and having procured the assistance of some of the inhabitants who could speak German, I set out, examining the neighbourhood in search of a vitreous-sand, or lightning-tube. After much trouble, I at length found one, and the first which has been discovered in the dominions of the Emperor of Austria. The place where it was found was the highest point of a low sand-hill, about half a league from Zankendorf, near Malaczka, in a northerly direction. The upper part of the tube was nearly half an inch in diameter, from which I concluded it would sink very deep. After we had dug down about two yards, we came to a layer of pebbles, and then to a layer of clay, below which I was sure the electric fluid would not have penetrated. At first it had taken a slanting, and afterwards a perpendicular direction. Six inches below the surface, a small branch, four inches and a half long, (see Fig. 1.) went off from the main tube; and at the depth of thirty-two inches the tube divided itself into two branches. These branches terminated on the clay, one being seven inches and a half long, and the other nine, owing to the surface of the clay not being even. Below the tubes the traces of electricity, scattered over the clay, were visible, and it appeared as if it had been exposed to the action of fire. Immediately below, where the tube split into two branches, a large pebble was found, which was, probably, the cause of the division."

In the July Number of the Annalen, a Mr. Hagen, Professor of Chemistry at Konigsberg, gives an account of some peasants observing the lightning to enter the earth, on July the 17th, near the village of Rauschen, on the borders of the Baltic. They found two holes close to a high tree, where they saw the electric fluid descend, and the earth was hot all round the spot. On a closer examination, about a foot below the surface, immediately under one of the holes, a tube was formed, and parts of it found. It was, however, very thin, giving reason to believe, that the stream of electricity was not, in this instance, so great as in some of the others; and the outside was covered with black dust which in its properties resembled charcoal.

This latter account is of considerable importance, as confirming the conjecture that these tubes were caused by lightning. Hitherto this was only conjecture; but we may now set it down as fully ascertained. We may remark, in closing this Article, that this fact furnishes another proof of the great benefits which may be expected to result from imitating, by art, the processes of nature, whether the object to be accomplished is to add to the mechanical power, or to the chemical knowledge of man. In this case we have an example of the instant passage of electricity fusing one of the most infusible of substances: thus we are taught, that electricity may be used as a powerful instrument of chemical analysis; and we know that, following up this instruction, the galvanic battery has already been applied to extort several secrets from Nature.

CHEMISTRY AS A SCIENCE. Art. III.

OXYGEN.

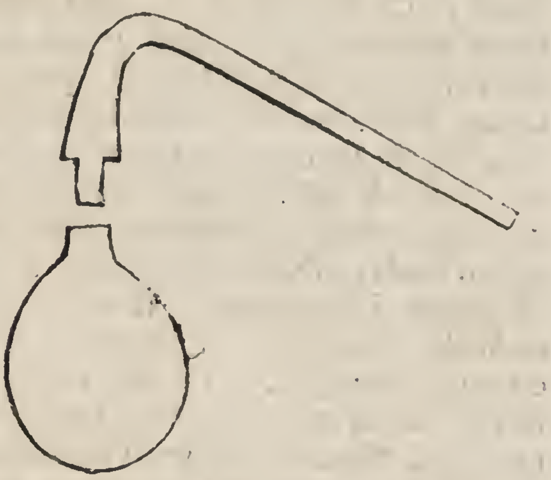
Oxygen, properly speaking, is the name given by Chemists to the base of oxygen gas; but all attempts hitherto made to procure this base, or to reduce oxygen gas even to a liquid state, have been wholly fruitless, and therefore it

must at once be admitted that the separate existence of this base is a gratuitous supposition on the part of Chemists, and has never yet been proved. Oxygen gas, however, may be obtained in great abundance, and it is this which we shall now describe. Its name is derived from two Greek words, signifying producer of acids; but modern discoveries make it doubtful whether this is a correct application. It is, however, now too late to alter it, unless a change in nomenclature is a less evil than having a word which, to the great mass of persons, does not express the misapplied attribute.

Oxygen gas, the substance now to be described, is, both from the nature of its properties and its wide diffusion through all the different parts of matter, one of the most important bodies with which Chemistry has ever made man acquainted. Although no being can breathe without its presence, and no plant can live, and although it is the principal agent in all the phenomena of combustion, its existence was only discovered first by Dr. Priestley, on August 1st, 1774, and was obtained by exposing red oxide of mercury to a burning lens. In consequence of a theory which then existed, but which is now exploded, he called it *dephlogisticated air*. In 1774, Mr. Scheele, a very celebrated Swedish Chemist, without being at all acquainted with what Dr. Priestley had done, also discovered oxygen gas, and gave it the name of empyreal air. In the same year, Mr. Lavoisier, a French Chemist, equal in reputation either to Scheele or Priestley, succeeded, by his experiments, in expelling this gas from the red oxide of mercury, which first led him to suppose that metals absorbed a portion of atmospheric air when they were calcined, which may be considered as one of the facts that most conduced to establish the present and overthrow the phlogistic theory of Chemistry. Though the discovery of oxygen was of the highest importance, and may well be looked on as one of those events which, like the invention of the printing-press or the discovery of fluxions, has amazingly contributed to improve our knowledge of the particular science to which it relates, yet, from it having been made by two persons in countries remote from each other, though at no great distance of time, it would appear that it was, if we may so speak, a necessary discovery, and grew out of numerous other discoveries, which were then making in every place where Chemistry was studied. If neither Dr. Priestley nor Mr. Scheele had made us acquainted with it, some other person would. We do not say this to depreciate in any respect the great merit of these two distinguished Chemists: both of them, and more particularly our own countryman, whose researches were not confined to Chemistry, have illustrated their names by several great and useful discoveries; but it appears to us, while we are humbly endeavouring to promote a knowledge of one branch of the external world, we may also sometimes take an opportunity of promulgating a truth of some importance, though not exactly scientific. This great discovery, though it very properly fell to the lot of two men who had long engaged themselves with chemical researches, was not so much the result of their individual exertions, as of the general progress then making in Chemistry in the whole of Europe. It is one more proof of the fact, that every great and useful discovery is the result, not of particular circumstances or of chance, as it is sometimes expressed, but of general laws; and we dwell on it with pleasure, as the surest guarantee men can possess that the progress of society does not depend on accident, and is as certain as the laws of nature are permanent. We have individually, too, a pleasure in reflecting on this fact, and pointing it out to the notice of our readers, because we infer from it, that though ungifted ourselves with any power to add to the stock of knowledge, we may,

by more extensively diffusing what is known, awaken the slumbering genius of many Newtons, and be the cause of other men making discoveries; at least we shall secure for those who improve science a larger share of reputation, and a juster appreciation of their merit.

Oxygen gas, though diffused throughout nature, is then always combined with something else, and is never found or obtained pure but by some chemical means. We are not only indebted to Chemistry for a knowledge of its existence, but in its pure state it must be considered as a product of the laboratory. In our first Number, we described two separate methods of obtaining it; the following is another:—Take an iron bottle, capable of holding more than an English pint, of the shape represented in the figure.



To the mouth of this bottle a bent iron tube is to be fitted by grinding; and for this purpose a gun-barrel, with its butt-end cut off, answers very well. Into the bottle put, in a state of powder, black oxide of manganese, a substance much in use with bleachers and other manufacturers; fix the iron tube into the mouth of the bottle, and make the joining air-tight by the luting recommended in last Number. Put the bottle into a common fire, and surround it with burning coals. The heat of the fire first expels the atmospheric air contained in the tube, which soon ceases, however, to pass off. When the bottle has become obscurely red, air again issues from the end of the tube, and becomes more abundant as the heat increases. The mouth of the tube is now to be placed in the pneumatic apparatus, exactly under the opening of the glass jar D. (in the plate of Number II.) The air gradually ascends to the top of the glass and displaces the water. The glass should be removed before all the water is forced out, and the dish or saucer in which it is removed should contain a little water, in order to prevent the escape of the air. After one glass is removed, another may be placed over the tube till as much of the gas is collected as is required. The air contained in these glasses is oxygen gas.

The method now described was discovered and employed by Dr. Priestley; the second method, described in Number I., is the method which was used by Scheele. The first method, described in our first Number, is, however, better than either of the others for obtaining the gas in a state of purity. There are several other methods of obtaining it, but these are the easiest, and most generally employed. From whatever source obtained, the properties of oxygen gas are always the same, and are as follows:—It is colourless and invisible, like common air; it is elastic, like it, and susceptible of being compressed by mechanical means, having a tendency to dilate itself as the pressure is removed. It is found to be somewhat heavier than common air. Taking the specific gravity of the latter as 1.000, the specific gravity of oxygen gas is 1.1111, or, according to some authorities, 1.1115.

If a lighted taper be placed in a jar filled with oxygen gas, it burns with a splendour which the eye hardly dare look on; and the heat which it gives out is much greater than when burnt in the atmosphere. After a short period, the candle is extinguished. The same effect takes place if a candle is immersed in a jar of common air, from which the access of every fresh supply is excluded; but the candle burns longer in oxygen gas than in common air. Oxygen gas exists in a

great quantity in the atmosphere, and as a candle will not burn in the other gases with which it is there combined, it has been concluded that it is the *oxygen* alone of the atmosphere which supports the flame, and that without its presence, combustion, or what is, in common language, called burning, could not go on. In fact, it has been supposed, that combustion is, in all cases, only a rapid union of the combustible substance with oxygen, the heat and light being emitted either by the combustible, by the oxygen, or by both. Although this theory has been carried further than our knowledge at present warrants, for we cannot now say, since potassium burns in sulphuretted hydrogen, neither of which bodies contain oxygen, as far as we know, that this substance is necessary to combustion, and that it will not go on if oxygen be not present; yet it has been demonstrated, that in all ordinary cases of combustion, oxygen combines with the combustible substance, and all fires kept up by the action of atmospheric air depend for their activity and intensity on the quantity of oxygen it contains. Admitting, therefore that some other substances may possess the same property when in our laboratories, yet they are only, as far as we know, sparingly diffused; and oxygen gas is the great agent in all the alterations, whether the produce of nature or art, which are effected by means of fire. One conspicuous property, therefore, of oxygen gas, is that of supporting and promoting combustion; and it has been demonstrated, with very few exceptions, that the phenomena of combustion and the emission of heat and light are caused by a rapid union of oxygen with the substance consumed.

Though oxygen plays such an important part in all the phenomena which go on in dead matter, or in the unanimated part of creation, it is of not less importance in all the phenomena of life, both in the vegetable and animal kingdoms. It was proved long ago, by the great philosopher, Boyle, that animals cannot live without air, and by Mayow that they cannot breathe the same air for any length of time without suffocation. Dr. Priestley and various other philosophers have proved that animals live much longer in oxygen gas than in common air. It is even the oxygen gas alone of the atmosphere which seems to be consumed in respiration; and numerous experiments show that a quantity of it proportionate to the size of the animal is always absorbed by breathing. An ordinary man consumes about 32 ounces of oxygen gas every 24 hours; and to give the reader some idea of the immense quantity of it in bulk which is required, it is only necessary to state, that 100 cubic inches, at the common pressure, do not weigh above 30 grains. To supply the immense quantity of this gas, which is thus necessary for the existence of animals all over the globe, it is constantly reproduced by a beautiful provision in nature, which we shall hereafter describe.

Although oxygen gas is so necessary to life, it has, however, been also distinctly ascertained, that pure oxygen gas by itself is not well adapted to animal existence. An animal confined in it breathes in a hurried and laborious manner, and at length dies, even though a sufficiency of oxygen gas is present to sustain the life of another animal of the same species. Plants, also, it is stated, will not vegetate unless oxygen gas have access to their leaves. The whole theory of respiration, and the whole of the important part which oxygen gas performs in this function, which is necessary to all animal life, is not yet known. Enough striking facts have, however, been ascertained, to show that oxygen gas is the stimulating, and, we had almost said, the life-giving principle of the atmosphere. Air in which it is contained in abundance, increases the circulation of the blood, and imparts to the human frame all the marks of a more intense vitality; while, on the contrary air in which it is deficient, which

is contaminated by the breath of numerous persons, or the action of large fires, is found to be little stimulant, and the persons who breathe it become languid, dull, and weary, as if the springs of their life were drying up. So striking and important, indeed, is this property of oxygen gas, that it was formerly called *vital* air, and a very distinguished Chemist of the present day, in the ardour of youthful imagination, did not hesitate to promulgate, at least in his conversation, an opinion that this gas was the essence of all vitality; that the mind of man was strong and vigorous in proportion to the oxygen contained in his frame and inhaled by his breath; and that oxygen was synonymous with what some ancient philosophers called the soul of the world. Although such a theory exceeds the bounds of our knowledge, the importance, and even the necessity of oxygen gas to the continuance of healthy animal and vegetable existence cannot be denied; and its use in supporting life may be considered as one of its most distinguishing properties.

In our classification, we stated that it was one of those few bodies which are evolved at the positive electrical pole, and of all bodies it appears to have this property in the highest degree. It is a necessary consequence of the other simple substances being evolved at the opposite pole, to suppose that when a compound substance containing oxygen is evolved at the positive side, that this is entirely owing to the presence of oxygen gas, and that no compound in which it, or one of the other simple substances having the same property, does not predominate, is ever evolved at this pole.

Of course a substance so important is extensively diffused. It is found in great abundance in the atmosphere, in the animal, in the mineral, and in the vegetable kingdoms. Twenty-one parts out of the hundred, in bulk, of the atmosphere, are oxygen gas; almost all the remainder is azotic gas or nitrogen. Of water, eighty-five parts out of the hundred, in weight, are oxygen; the other fifteen parts are hydrogen. Nearly all the products of combustion contain oxygen; and in almost all acids it is one main ingredient. The philosophic observer, who delights in tracing general laws, and who is struck with admiration at finding that—

> "That very law which moulds a tear,
> And bids it trickle from its source;
> That law preserves the earth a sphere,
> And guides the planets in their course,"

will be equally pleased at discovering that oxygen gas is possessed of the same properties wherever the researches of man have reached. It is found at the top of the highest mountains, and has been brought down from the heights of the atmosphere by those aërial voyagers who, in search of knowledge, have ventured even to soar far beyond the eagle's utmost flight; it is met with wherever the miner has sunk his shafts; and it springs, forming one element of water, from the lowest depths to which the instruments of man have penetrated.

ACETAT OF MORPHIA.

Since our last we have seen one foreign Journal in which some further information is contained on the subject of this poison. We observe with pleasure, that while the Chemists of our own country are condensing the gases to make them mechanic powers in the hands of man, our continental neighbours are engaged in the discovery of subtle poisons. In the Institute, on Monday, Jan. 26, M. Dublanc, jun., an apothecary of Paris, announced to this learned body, that he had found in the alcoholic tincture of nutgalls a very sensible test proper to detect the presence of morphia in liquids, whether that substance exists in them uncombined or combined with either acetic or sulphuric acid.

M. Vauquelin, on the same day, made a report on a memoir of M. Lassaigne, on this subject, from which it results, 1st, That it is possible, in many cases of poison,

by the action of morphia, to detect evident traces of this substance. 2d, That it is always in the viscera, to which the poison has been carried, that remains of it must be sought. 3d, That the substances rejected by vomiting, a short time after taking morphia into the stomach, contain a considerable quantity of it. 4th, That it is not possible, as far as we know, to discover any traces of acetat of morphia in the blood of any animal poisoned by it.

M. Lassaigne proceeded in this way:—If the presence of acetat of morphia was suspected in any liquid, he evaporated it by a gentle heat; he then treated the residuum with alcohol, to separate the animal matter and dissolve the acetat of morphia, as well as the osmazome and any salts. The alcohol is then evaporated. The residuum is dissolved in water, to separate a greasy substance, and this solution is allowed to evaporate spontaneously. When it contains acetat of morphia, it crystallizes in divergent prisms, of a yellow colour, which are known by their bitter taste, by ammonia decomposing them, by acetic acid being disengaged when concentrated sulphuric acid is added; and, finally, by an orange red colour, which they assume when treated with nitric acid. If the acetat is, however, in very small quantity, it remains mixed with the osmazome, and will not crystallize; and in this case nitric acid detects its existence, by the orange red colour. If the examination is to be made of a solid substance, it is boiled about ten minutes in the water, and the above method is then pursued with this decoction. If the substances in which the presence of acetat of morphia is expected are of an alkaline nature, it is necessary to add to the alcohol or to the water a small quantity of acetic acid, to restore the acetat of morphia, which may have been decomposed.

Following this method of proceeding, the author found the acetat of morphia, 1st, in substances vomited by animals to which the acetat had been given; 2d, in the stomach of a cat, which died after taking five grains of the acetat, but he found none in the intestines, in the heart, or in the blood of the same animal; 3d, in a liquid in the thorax of a dog, which died in ten minutes after the injection of fourteen grains of the acetat; 4th, in the small gut of a cat, which died in ten hours after eighteen grains of this substance had been injected into this intestine; 5th, in the duodenum of a dog, which died in four hours and a half after eighteen grains of acetat had been injected into the duodenum; but no acetat of morphia was found in the blood of a dog, which was bled twelve hours after thirty-six grains of this poison had been injected into the crural vein.

CHEAP WINE AND BRANDY.

The following methods of making those cheap Wines and Brandies, which the unwary lover both of money and liquor is tempted to buy, from seeing large placards stuck up in every part of the town, is taken from a pamphlet lately published by a wine-merchant. In addition, however, we must observe, that many of the ingredients out of which the cheap articles are made, are not of Nature's Chemistry,—are not the produce of the vineyard, but of the laboratory: —

	s.	d.
Take 2-3ds Cape, cost 15s. per doz.	10	0
Take 1-3d very strong young Sherry or Teneriffe, Madeira, Lisbon, &c. the cheapest kind of Sherry, yet best calculated to mix in this manner, on account of its overpowering body and strong new flavour, cost 32s per doz.	10	8
£1	0	8
Apparently cheap price 2	2	0
Cost.................. 1	0	8
Profit........ £1	1	4

What a bargain! says the Purchaser

Cent. per cent. says the Vender.

Now for some Cheap Brandy, at 22s. 6d. per gallon, the Duty being 19s. per gallon:—

		s.	d.
Take 1-5th Alcohol		6	0
1-5th young and cheap Brandy		4	6
1-5th British Spirits		2	6
2-5ths Water		0	0
Burnt Sugar and Molasses		0	2
Total cost		13	2
Cheap price	1	2	6
Cost	0	13	2
Profit	£0	9	4

		s.	d.
Or—Young Brandy		5	6
Alcohol		5	0
Grains of Paradise		1	2
Burnt Sugar		0	2
Total cost		11	10
Cheap price	1	2	6
Cost	0	11	10
Profit	£0	10	8

How is it possible to sell Brandy at *1l. 2s. 6d.* in *England; the duty in England, and the prime cost in France*, exceeding that sum even for the inferior *description?*

Does this explain how the amazing number of advertisements are paid for, both in town and country?

TO CORRESPONDENTS.

We differ in toto *from T. G. as to our motto. It does not in the least apply, as he insinuates, to the doctrine of chance; and it is taken, with a very slight alteration, from one of the most religious, as well as the most moral and most sublime poets who have ever written in the English language—Akenside. We did not put his name, because we ventured to transpose his words and thoughts.*

We thank Biblious, we believe it should have been written Bilious, *for his hint; and take the liberty of informing him, however crabbed he may be, that our digestion is light, and that our blood runs both smoothly and calmly. We will not make attacks on any individuals; but we shall never be backward to hold up to ridicule the pretensions of ignorant quacks. We remember long ago, being at the lecture of such a one, to whom we put some questions relative to Sir H. Davy's supposed discovery of the metallic base of azot, which was then making some noise in the world, and were told, with great pomp of words and manner, that this was by far too high a matter for the curiosity of a student. The fact was, that he could exhaust an air-pump, having been a labourer, but was then as ignorant of the science as when he was first taken to wash the bottles of an eminent Chemist.*

The suggestion of D. J., Manchester, will, in due time, be attended to. "CHEMICAL ESSAYS," *by Mr. Parke, as far as they go, is a book of the nature he alludes to, but it embraces only a very few parts of practical and experimental Chemistry.*

The description mentioned by A Chemist will be acceptable. His letter meets, in all respects, our concurrence.

Messrs. P. D., J. T., J. S., and R. T. are referred to our next Number.

*** Communication (post-paid) to be addressed to the Editor, at the Publishers'.

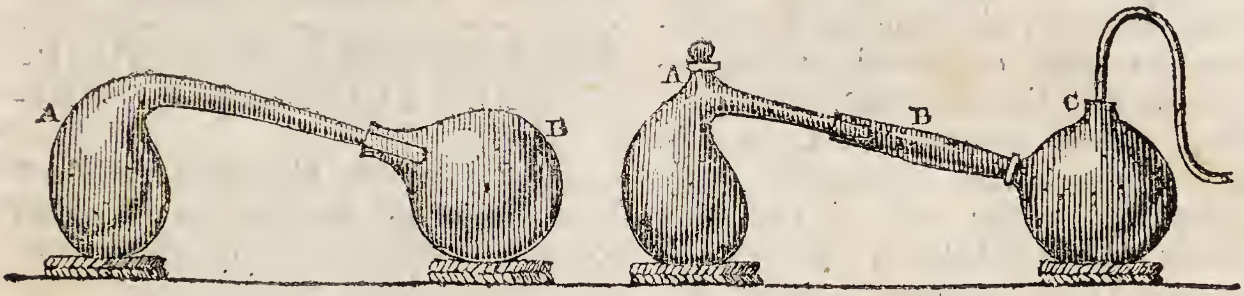
London: Published by JOHN KNIGHT and HENRY LACEY, 24, Paternoster Row.

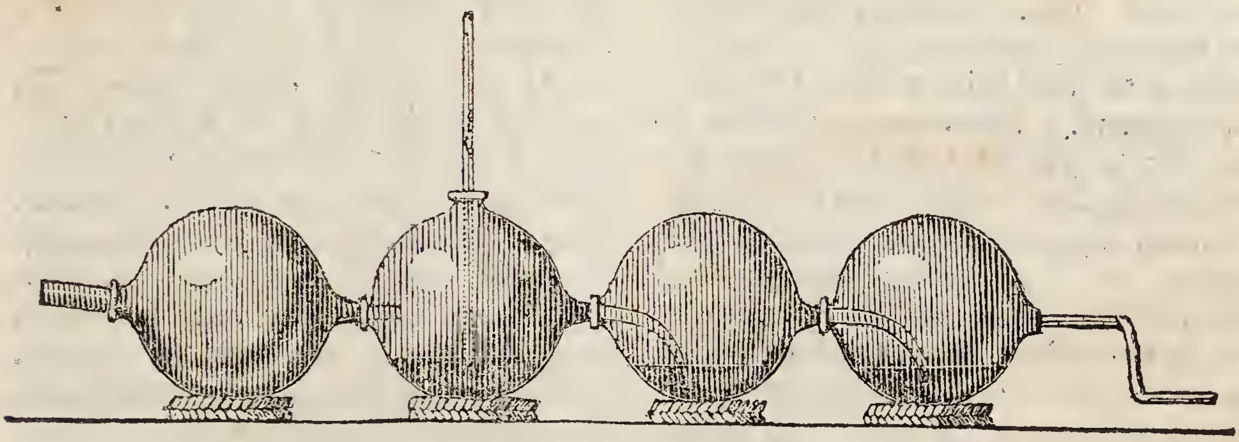
B. Bensley, Bolt-court, Fleet-street, London.

The Chemist.

"—— Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. IV.] SATURDAY, APRIL 3, 1824. [Price 3*d*.





CONTENTS.

CHEMICAL APPARATUS.

Description of the Plate.

A, Fig. 1, is a common retort, or conical bottle, the neck of which is bent at an angle of 60 degrees, and the mouth of it adapted to a receiver. It is very convenient for distilling, when the substance to be distilled over separates easily, is easily condensed, and the heat required is not too great. The product may be condensed in the

receiver. Sometimes it is convenient to have it constructed as in Fig. 2. In this there is an additional tube, B, in order to increase the distance between the retort and the receiver. The upper part of the retort has also an opening, and is supplied with an air tight glass stopper, at which the first portions of air or gas may be permitted to escape when necessary. In some cases of distillation, the product is not only a gas or vapour, which condenses, but also an elastic fluid, which is incondensible. To provide for this case, the receiver is supplied with a bent tube, C; the condensible product is then collected in the receiver, and the incondensible product passes through the tube, and is either allowed to escape, or is collected by the end of the tube being carried into a pneumatic trough, in the manner before described. Fig. 3 is a representation of one of the most approved adaptations of what is called Woolfe's apparatus. The use of this is to obtain a product not condensible by itself, but which may be condensed by coming in contact with water, or by being transmitted through it. It consists of a series of glass globes, from each of which a tube issues straight at the neck, so that it can be fitted by grinding into another globe, but having such a curvature, that the extremity of it dips into the liquid contained in the globe into which it enters. A retort is adapted to the first globe, which is designed to collect the condensible part of the product. Water is put into each of the other globes, as high as the dotted lines; and the neck of the globe passing into this water, transmits the gas through it, which is thus absorbed. Any gas which is not absorbed, passes off at the bent tube at the end, and may be collected in the ordinary way. In the second globe, is what is called a tube of safety. This apparatus requires no lute; and has this advantage, the retort may be removed at any stage of the process, to weigh what has been lost. In general, heat is applied to the retort by means of a sand-bath, which consists of sand heated to any requisite degree, or by means of a water-bath. A greater heat may, however, be applied, if a proper retort is used. This is a very useful apparatus, as, in many chemical experiments, more than one, two, or three products are obtained, which are thus, according to their properties, condensed in the first globe, combined with water, or condensed, by its means, in the others, or passed off into the pneumatic trough, and there collected or suffered to escape altogether.

MR. GURNEY *v.* THE QUARTERLY JOURNAL OF SCIENCE.

Last year Mr. Gurney published "*A Course of Lectures on Chemical Science, as delivered at the Surrey Institution*, which was reviewed in the 32d Number of the *Quarterly Journal of Science* in such a manner as to excite his displeasure. In answer to the Review, he has published a small pamphlet, under the title of a Letter to W. T. Brande, Esq., the Editor of the Quarterly Journal, and Professor of Chemistry at the Royal Institution, where the Quarterly Review is edited. In this letter Mr. Gurney attributes the severe strictures of the reviewer to a wish, on the part of certain persons connected with the Royal Institution, to crush him. On this point Mr. Gurney has probably overrated his own importance; and, imagining himself in opposition to certain distinguished Chemists, has attributed an hostility in them to rising genius, utterly unworthy of their talents, and by no means called for, either by the novelty or value of his discoveries. Without entering into the motives of either party, we feel ourselves bound, for the honour of the science we cultivate, to mingle in the dispute between him and the "Quarterly Journal." We are unacqainted with both parties, and only wish, on the one hand, to protect the science from an inundation of false theories; and, on the other,

to prevent an individual from being put down, merely because his views are opposed to those of some scientific sect. We have read enough to know that few theories are incontrovertibly established; and whenever we find persons more tenacious of supporting a particular set of doctrines than of eliciting truth, and more clamorous than rational in argument, we are led to believe that they begin to suspect the correctness of the system they defend.

The complaint of Mr. Gurney, putting aside what he says of improper motives, is, that his "Lectures on Chemical Science contained some views which were both novel and important; that the Reviewer, after announcing his intention to take notice of these views, pretends not to understand them; and thus vilifies what he should have shown to be erroneous before condemning; that he makes garbled extracts, misrepresents passages, and has altogether given an unfair review of the book." If these charges are substantiated, such a proceeding, from whatever motive it may have arisen, is quite unworthy of the Journal which pretends to be the first scientific Journal of this empire. Of course, the first part of the charge implies that Mr. Gurney has made some important additions to our knowledge; and he points to his third Lecture, as containing a novel and juster theory of crystallization than has before been published. If it cannot be shown that Mr. Gurney has made such an addition to our knowledge, all his remarks against the Reviewer fall to the ground.

If we understand his *discovery*, it is this:—Dr. Wollaston, Haüy, and others have assumed that the primitive molecules of matter have three original distinct forms. "No," says Mr. Gurney, "they have only one; and I will undertake to show how all the phenomena of crystallization may be accomplished, and all the various forms of crystals produced, by all the elementary substances, or atoms, or molecules of matter having only one form, and that form the most simple possible, namely—the sphere. It is a fact, admitted both by Mr. Gurney and his opponents, that to form compound bodies, the primary atoms of matter unite in certain definite proportions. Mr. Gurney lays it down as a law, that all the atoms of the same elementary body are mutually repellent, and the atoms of different elementary bodies are mutually attractive; he then states, that in compounds where the atoms of the different elementary substances are combined in the proportion of one and one, the form must be a cube; and he says, in fact, bodies chemically so combined, have this figure; that bodies in which the spherical elementary atoms are combined in the proportion of two to one, must necessarily have a figure with angles of 60° and 120°; and he affirms that bodies chemically so combined crystallize in this form. It is not in our power, particularly without his elucidating diagram, to follow Mr. Gurney through all his illustrations, which are, however, very few; it is sufficient for us to state, that he has endeavoured to simplify the theory of crystallization, by showing how all the various crystals may, and, admitting the doctrine of chemical proportion, must assume the forms in which we meet with them, on the supposition of all the atoms or molecules of all the elementary bodies having the form of a perfect sphere. To us, who conceive the whole doctrine of atoms to be a mere vision of some philosophic brain, which, disdaining the common indulgencies of imagination, dreaming of houris and nectared fountains, and marble palaces, and golden statues, and ever-blooming gardens, indulges in the more lordly and creative work of framing out a universe anew, all this discussion about the primary form of atoms is little better than trifling amusement; and *we* might pass by Mr. Gurney's pretended discovery, as something like an idle dream; but the Reviewer, it must be remembered, is a stickler for the

doctrine of *atoms*, and, labouring even in this very Number of his Journal to recommend an opposite theory of crystallization to the notice of his readers, it was his business to show the incompleteness or the fallacy of Mr. Gurney's theory. He has not done this, and he has vacated the chair of rational criticism to indulge in low sneers and unmeaning notes of admiration and italics. This is utterly unworthy of a Journal edited at the Royal Institution. The Reviewer should have pointed out Mr. Gurney's errors, and warned the younger part of the scientific world from wasting their time and money in similar pursuits. That there are in Mr. Gurney's book several strange forms of expression, some visionary doctrines, and some very far-fetched assumptions, is quite plain; but being combined with many acute observations, and with an inventive disposition on the part of Mr. Gurney, we must say that the attempt to sneer him down looks something like an effort on the part of the Royal Institution to stifle talents which have not grown into notice under their protection.

Mr. Gurney's other charge is, That the Reviewer has taken garbled extracts from his work. Let us see, then, if this accusation be true. The Reviewer says, p. 302, "We are told, in p. 46, that the *crystals of alum* EXACTLY RESEMBLE *those of natural quartz*." He quotes this paragraph to show Mr. Gurney was ignorant of the difference between the crystals of alum and those of quartz. In his Letter, Mr. Gurney explains, that the passage was meant to convey an idea that crystals artificially produced were deposited in a manner similar to that employed by nature. Here is the passage, and we ask the candid reader which sense it conveys. "In a short time the *crystals of alum will be found to have* DEPOSITED *themselves about it*, (*a matrix*,) *in perfect* IMITATION *of natural quartz*." The Reviewer, therefore, not only misquotes the words, but imputes a meaning to the passage which it does not convey. At page 306, the Reviewer quotes as follows:—"Nitrogen, I suspect, is a peculiar compound, formed by the organs of the animal body, and not a simple element, as is generally supposed." —here he stops: Mr. Gurney adds, "when it is submitted to galvanic influence it neither goes to one pole or (nor) to the other, but holds almost a neutral situation between the two." The Reviewer makes this quotation, to sneer at Mr. Gurney; and certainly a mere supposition, without assigning any reason for it, that nitrogen is a compound substance, looks very ridiculous. But it is somewhat remarkable, that the same Number of the Quarterly Journal, and perhaps the same Reviewer, in an article on Dr. Henry's Chemistry, lays down the "the electrical relations of the elementary and undecompounded bodies," as the principles on which to found chemical classification; and the subsequent part of the paragraph should therefore, according to his own doctrine, justify the first part, which he endeavours, quoting it by itself, to render extremely ridiculous. In the same page, the Reviever, by omitting the word "*seems*," converts a passage, in which Mr. Gurney is speaking of phosphorus from a conjecture, to an absolute assertion. These instances are, we think, sufficient to justify Mr. Gurney's second accusation. The Reviewer has misquoted his book, and made garbled extracts. In fact, with the exception of a well-known bantering Magazine, we never remember to have witnessed, in any Journal possessing the least character, above all in a scientific Journal, so flagrant a violation of the just rules of criticism. We are not insensible to the gross defects of Mr. Gurney's book; and it must be stated, that he has laid himself open to much severe criticism, by a hasty publication. No man has a right to expect that his unpruned conjectures should be received as established facts; and till Mr. Gurney had found an opportunity of illustrating and confirming his theories, he should have

withheld them from the public eye, or put them forth in a more modest form. For this he is blameable, and for this he should have been censured; but there are marks of genius in his hasty production, sufficient to have redeemed it from unsparing and unqualified censure. There is one chapter devoted exclusively to the blow-pipe, which Mr. Gurney has been at considerable pains to improve. This chapter and Mr. Gurney's improvements are passed by in the Review without any other notice than stating there is such a chapter. We may be mistaken, but we consider the instrument as improved by Mr. Gurney, much safer than before, and shall take an early opportunity of submitting an account of these improvements to our readers.

CHEMISTRY AS A SCIENCE.

Art. IV.

CHLORINE.

The substance now known by the name of Chlorine to Chemists, was, up to the year 1810, called by them oxymuriatic acid. The latter name was given to it on the supposition that it was a compound substance, consisting of muriatic acid and oxygen. A different opinion was first formed, perhaps about the year 1808, but it was in 1810 that Sir Humphrey Davy published his account of the experiments he had made on this substance, whence the conclusion was drawn that it was a simple substance, to which the name of Chlorine was given, from its yellow colour. Since that time, the great majority of Chemists have adopted the views of Sir Humphrey Davy, and chlorine appears in most of the elementary treatises on Chemistry as a simple substance, classed along with oxygen, either from its electrical property, or from its being a supporter of combustion. In papers like these, intended only to give an outline of the most general and best established facts of the science under an arbitrary arrangement, and to show, as well as we can, the relation of these facts to one another, and the mutual dependence and connexion as a whole, we cannot enter at all into the discussion of the question, whether chlorine be or be not a simple substance. We are bound, however, to remark, that many eminent Chemists, in different parts of Europe, still adhere to the opinion, that chlorine is a compound substance. Nor can we give, on the present occasion, even an outline of the many nice and delicate experiments made to decide the point, and of the fine and subtle theories which have been advanced on both sides of the question. Consistently with the purpose we have in view, we must confine ourselves to remarking, that Sir Humphrey Davy being unable to obtain any oxygen from this substance by exposing it to the action of charcoal heated to whiteness, which in this state has a great avidity for oxygen, concluded it contained none; and having afterwards subjected it to a great number of experiments, with a view to decompose it, and being unable to obtain any other product but it as long as it was perfectly dry, he concluded that it was a simple substance. His opponents say that the presence of water being necessar to the existence of muriatic acid, as long as there is none present the oxymuriatic acid will not give up its oxygen, but that wherever water is present muriatic acid is formed, and oxygen evolved. At any rate, chlorine must be considered as a simple substance only in the strict chemical meaning of that term, viz. it has not been decompounded. Oxygen gas, we have seen, performs a most important part in all the phenomena of life; and in many of the changes which constantly take place in unorganized substances. Chlorine, on the contrary, is solely a product of art; it enters into no important natural combinations, except that of common salt; it is not necessary for the continuance of existence, and, except as it has been applied to some useful purposes in the arts, it seems of little importance in the

economy of nature. Admitting, therefore, on the single chemical ground of art never having yet decomposed it, that it is a simple substance, it does not at the same time possess any of those grand characteristics which lead the mind to rely, as in the case of oxygen, on the Chemist's analysis, and to believe that here he has really discovered an element of nature.

Chlorine is obtained in the following manner:—Put into a small glass retort a quantity of the black oxide of manganese in powder, and pour over it as much of the common muriatic acid, which is to be got in all Chemists' shops, as will make the whole into a thin paste. Plunge the beak of the retort into the pneumatic trough, under a stout glass phial filled with water, as already described, and apply the heat of a common lamp to the bottom of the retort. A gas rises which displaces the water in the phial, and this gas is chlorine. It was discovered by Mr. Scheele, the celebrated Swedish Chemist, about the year 1774, and was by him considered to be muriatic acid, deprived by heat of an imaginary substance, called phlogistion, and hence named de-phlogisticated muriatic acid. On the French theory of Chemistry growing into fashion, it was considered as a compound of muriatic acid and oxygen, and therefore called oxymuriatic acid. As we have already stated, since the experiments of Sir Humphrey Davy, it has been supposed to be a simple substance, and under this supposition it is called chlorine, from its peculiar colour.

It is a gaseous body, possessing all the mechanical properties of common air. Its colour, which is hardly perceptible by candle-light, is greenish yellow. Its taste is astringent. When breathed, mixed with atmospheric air, it produces a most insufferable sensation of suffocation, occasions violent coughing, with much spitting, followed by great debility, and if breathed in its pure state it destroys life almost instantly. It is two and a half times as heavy as common air, its specific gravity being 2.500, taking that of common air as 1000. It possesses the very peculiar property of destroying all vegetable colours, and of rendering most substances white. This property has led to its employment as an agent in bleaching, and by it most of the cloths now manufactured in this empire are made of their dazzling whiteness. Mr. Scheele first observed this property in chlorine; M. Berthollet, a French Chemist, first recommended its employment in bleaching; and the celebrated Mr. Watt, of Birmingham, was one of the first persons to introduce it into Great Britain.

Though chlorine will not support life it supports combustion. A candle burns in it with a low red flame, emitting much smoke and little light. Phosphorus, antimony, arsenic, zinc, iron, and several other metals take fire when plunged into chlorine, and burn with considerable splendour. In these cases the gas diminishes or disappears, and the combustibles are converted into new substances, which are considered as compounds of them and the chlorine, and have received the name of *Chlorides.*

Water absorbs a quantity of this gas equal to twice its own bulk; and the water acquires the colour, smell, taste, and whitening properties of the gas itself. The electric property of chlorine, viz. that of being deposited at the positive pole of the galvanic battery, has already been mentioned as the only characteristic which has made us place it here. It combines with various other substances; but we shall postpone till a later period all remarks on compound substances. In our next paper we shall describe Iodine, and say what can be said of Fluorine.

TO RENDER BODIES LUMINOUS IN THE DARK.

If a four or six ounce phial, containing a few ounces of liquid phosphorus be unstopped in dark-

ness, the vacuous space in the bottle emits a sufficient light for showing the hour of the night by holding a pocket watch near it. When the phial is again corked, the light vanishes, but reappears instantly on opening it. In cold weather, it is necessary to warm the bottle in the hand before the stopper is removed: without this precaution it will not emit light.

Liquid phosphorus may likewise be used for forming luminous writings or drawings: it may be smeared on the face or hands, or on any warm object, to render it luminous; and this is in nowise hazardous. If rubbed on the face, taking care to shut the eyes, the appearance is most hideously frightful; all the parts appear to be covered with a luminous lambent flame, of a bluish white colour, while the mouth and the eyes are depicted as black spots.

This luminous appearance is a real, though slow combustion of a very minute portion of phosphorus presented to the air, which is partly wafted away in luminous vapours, and partly converted into phosphoric acid.

The bottle containing the liquid phosphorus must be kept in the dark, because light decomposes the solution of phosphorus.

TO MAKE A FINE GREEN PIGMENT.

A given weight of verdigris is to be dissolved by heat in a copper vessel, in a sufficient quantity of pure vinegar, and then an aqueous solution of an equal quantity of white arsenic added. Generally a dull green precipitate falls, which must be re-dissolved by adding more vinegar. The mixture is then to be boiled, and after some time, a crystalline precipitate appears, of the finest green colour, which, separated, washed, and dried, is the substance in question. If the liquor still contains copper, arsenic is again to be added; or if it contains an excess of arsenic, the preparation of copper must be added, and the process carried on as before. Sometimes the liquor contains an excess of acetic acid, and may then be employed to dissolve verdigris, as at first.

CURE FOR DRY ROT.

Take two ounces of white arsenic in powder; dissolve it by boiling it in one gallon of soft water. If boiled in an iron or tinned vessel, add half an ounce of copper filings, but if in an untinned copper vessel, the filings are not necessary. To a quart of size and half a pound of common tar, add a small quantity of fresh slaked stone-lime, sifted pretty fine; beat them well into a paste, which should be then nicely dissolved with the above solution, gradually adding, during the process, (by small portions) as much more of the pulverized lime as will give the whole a proper (rather diluted) body, to be laid on with a painter's brush. New work when finished, as a preventive, should be dressed with the composition at least twice, after well drying the first coat. Old work, as a curative, when removed and repaired, (such as diseased wainscot,) should be perfectly dried by exposition to the air, and then well dressed on its back before it is returned to its place.

VEGETABLE ALKALI IN HORSE-CHESNUTS.

The experiments of Messrs. Pelletier and Caventon on quinina, and the results they obtained, induced M. Francesco Canzoneri, of Palermo, to make a similar course of experiments on the fruit of the horse-chesnut, (*esculus hippocastanum*) which has been sometimes successfully employed as a febrifuge. By following the means they recommend, he obtained a peculiar substance from this fruit, which he has named *esculine*. Five pounds of the fruit, dried and pulverised, were treated with 80 pounds of water, rendered sour by sulphuric acid. The decoction allowed to cool, and lime being added, till a slight alkaline quality was produced, deposited a flaky precipi-

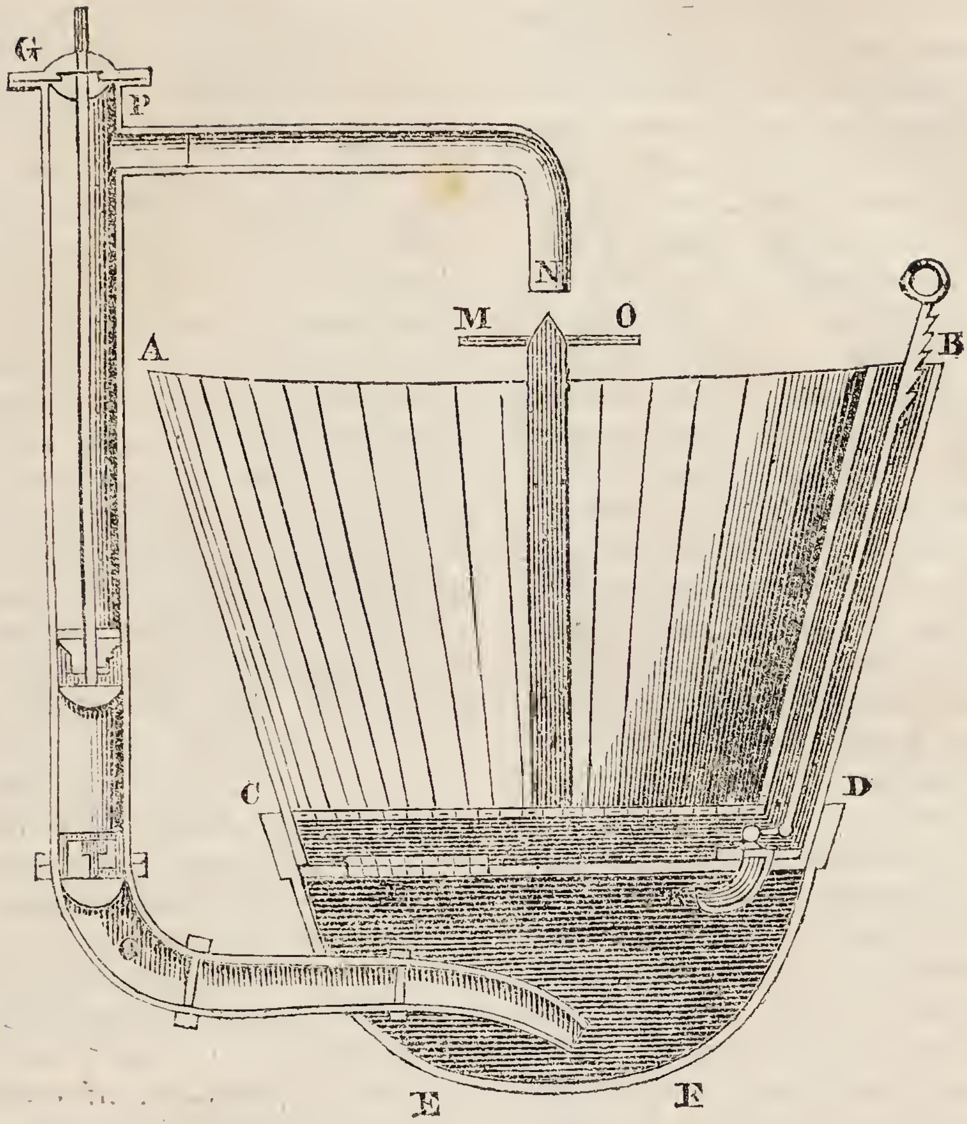
tate of the colour nearly of lemons. Washed, dried, and reduced to powder, this precipitate was exposed to the air, to facilitate the action of the carbonic acid on the lime. It was then digested with 30 pounds of alcohol, at the temperature of 90° for half an hour; and this operation was frequently renewed. The liquor was filtered and re-distilled, to recover as much as possible of the alcohol. The remainder evaporated to dryness, left the esculine behind. It is an amorphous mass, of a sweetish and very pungent taste, soluble in alcohol and ether; exposed to heat, the matter swells and burns in a manner analogous to oil. The author classes this substance with the other vegetable alkalies lately discovered.

BLEACHING SUGAR.

It is announced in a French journal, that *chlorate of lime*, which is now so extensively employed in bleaching linen, may also be successfully applied, both in its gaseous and liquid state, to bleaching sugar. As the gas is formed, it is conveyed into a solution of sugar previously filtered, and its absorption is promoted by agitating the sugar. When the colour which is required is obtained, the liquor is filtered over lime to separate the muriatic acid, and then over a preparation of animal carbon. Immediately after the filtration, the syrup is concentrated by the usual method. The gas may also be applied to sugar already crystallized, by spreading it over shelves, made altogether of wood, or of hair cloth, and placed round an apartment, into which the gas is conveyed as it is produced. The sugar is spread out on very thin layers, and is sometimes stirred by means of rakes. The sugar must afterwards be exposed to the action of lime to separate the excess of muriatic acid. The liquid chlorate may also be employed, by adding it to the filtered syrup, in the proportion of one-fifth, and agitating the mixture, then boiling it with animal carbon, filtering, and again agitating with another dose of chlorate, amounting to the sixth part of the whole. These operations are again repeated with the chlorate, in the proportion of a tenth part, and the syrup is finally filtered, and it passes clear and transparent like water. In the second mode of application, the animal charcoal is first added, and then the chlorate, after which the same agitation and filtering, as above described, is again to take place. The chlorate may also be employed to bleach molasses, so that it may be used on several occasions, when it is now rejected in consequence of its colour. The author gives no estimate of the advantages of employing the chlorate of lime, and, therefore, we are quite unable to say, whether his method is an improvement or only a novelty.

OIL FOR CLOCKS, WATCHES, AND OTHER FINE INSTRUMENTS.

Within a few years, a M. Chevreul has devoted a great portion of his time to the analysis of animal substances, and has made some remarkable and valuable discoveries. It results from his investigation, that all fat is composed of two distinct substances: one of which, called *elain*, remains fluid at the ordinary temperature of the atmosphere; the other, called *stearine*, easily becomes solid. The former should be used for all instruments of a delicate nature, to which oil is applied, to prevent friction. It is thus obtained: oil or fat is exposed to the action of eight times its own weight of alcohol, nearly boiling; the liquid is then poured off, and, on cooling, the stearine separates in crystals. The alcohol is then evaporated to the fifth part of the volume of the whole, and the elain remains, which is colourless, insipid, without smell, and difficult to congeal. Or, by squeezing tallow between the folds of porous paper, the elain is separated, and soaks into the paper, while the stearine remains behind. The paper being then soaked in water, and pressed, gives up the elain.



BLEACHING.

Art. II.

MODES FORMERLY IN USE.

THE first requisite to good bleaching was a favourable situation; and the gentle slope of hill, with a southern aspect, or a valley with a stream passing through it, was, in general, chosen for the purpose. A large supply of water is always indispensable; and the bleaching-grounds of Holland, and of other countries, when formed on the Dutch model, were intersected at right angles with numerous canals, at such a distance from each other, that a workman with an ordinary scoop, such as is used to throw water over the sails of a vessel, might easily wet all the linen lying on the space enclosed between the canals. Great care was taken to keep this water clean; and in Holland, where the flat nature of the country permits no *running* streams, and where the sluggish water rather stagnates than flows, the canals were themselves frequently cleaned out. They were provided with sluices, and tubs set in the earth at the corners, so that the water could always be drawn off at pleasure. Much of the superiority of the Dutch mode of bleaching arose from the cleanliness of that people, and the great care they take in all trifling matters. The object of all bleaching is the same; but as the colouring matters are different in different substances, it requires different processes to extract these matters, as the substance to be operated on is linen, cotton, silk, or wool. It would take up too much of our space to describe them all; and, therefore, in the little notice we are now to give of the former mode of bleaching, we shall confine ourselves to linen.

The colouring matter to be extracted from linen is supposed to be of a resinous nature; for, we must say, that, as yet, this point has not been precisely determined. It is known, however, that the quantity to be extracted from linen is much greater than that to be extracted from cotton; and hence, the process is longer and more expensive. It has been rendered pro-

bable, also, by some late experiments, that a great part of the colour of flax and hemp is imparted to them by the process of steeping and putrifying the plants; and that, consequently, a great saving would accrue if the fibre of the plant could be separated from the other substances with which it is combined, without sharing in that putrefactive process which is now employed. So great is the quantity of colouring substance extracted from linen thread, that it amounts to 27 per cent. of its original weight before it is perfectly bleached, while the loss of cotton yarn is only four and a half or five per cent. The first operation in bleaching was that of steeping, which consisted merely in immersing the brown yarn in hot water for three or four days, or placing it in cold waste alkaline lyes for forty-eight hours. This occasions a kind of fermentation, which separated many impurities from the yarn, and softened the whole so much, that they were afterwards easily removed by washing. In large concerns the washing was performed by machinery, which is now much improved; and, when the bleaching was on a small scale, it was done by hand, in river or spring water.

The next operation was what is technically called *bucking*, which consists in boiling the goods in an alkaline ley; and as this part of of the process is now continued, with some alterations, we have subjoined to this article a representation of the most approved bucking apparatus at present in use. After the linen or yarn had been well washed, it was regularly arranged in a large wooden vat or *kieve*, placed lower than a boiler, to be filled with caustic alkaline ley, which was heated to the temperature of blood. The boiler was then emptied by a stop-cock upon the linen till it was completely covered; and after remaining for some time, it was drawn off at the bottom of the kieve into another boiler placed beneath it, and thence pumped back into the first boiler. The heat was then increased, and the same process repeated, the heat being gradually increased till the alkaline ley was completely saturated with the colouring matter taken from the cloth, and which was, and is now, ascertained by its acquiring a disagreeable smell, and losing its causticity. It has been sufficiently ascertained, that vegetable substances, plunged at once into boiling liquids, have their colours, not extracted, but set fast; and cooks, who desire to preserve vegetables green for the table, never put them into the water till it boils. On the same principle, the colouring matter of linen would be set fast were it plunged at once into boiling alkali, and therefore the heat was applied gradually and slowly. It is also found, that applying cold water to linen while it is hot, has the effect of fixing the colour; and, therefore, it was, and is customary, after the bucking, to run warm water over the cloth, and gradually lower its temperature till it was of the same heat as the atmosphere, and the application of cold water was continued till it came away quite transparent.

In our plate, A B C D is the wooden kieve; C E F D represents a cast iron boiler; G G a pump; I K a pipe communicating between the kieve and the boiler, having a valve at both ends; that on the upper end, when shut, prevents the ley running into the boiler, and is regulated by means of the rod and handle, I B. The valve at K admits the ley, but opening inwards, prevents the escape of the steam through the pipe, I K. The boiler is provided with a steam-tight iron lid, I L; and at C D in the kieve is a wooden grating, a small distance above the cover of the boiler. M O is a broad plate of metal to spread the ley over the cloth. The boiler being filled with caustic alkaline ley, and the linen arranged in the kieve, the pump, G G, is set in motion by machinery; the ley flows through the pipe, N, and falling on the metal plate, M O, spreads in a perpetual current on the cloth; and the valve at K opening inwards, admits the ley to return to the

boiler. On the pump being set to work, a fire is lighted under the boiler, by which the temperature of the ley is gradually, and almost imperceptibly increased. When the ley begins to boil, the handle of the pump is detached from the machinery which first set it in motion, and the ley being confined in the close boiler, is forced up C C, and falls in a perpetual stream through the pipe, N, on the linen in the kieve. By means of this machine, the increase of heat is very gradual, and a current of fresh ley is constantly presented to different surfaces of the goods, the cleansing of which is thus promoted. Besides this, the machine, after being once set a going, is self-operating, which completely puts it out of the power of any persons to neglect the work. It possesses the additional advantage of saving a great quantity of alkali, which amounts to one-third or one-fourth of the quantity formerly employed.

After the bucking was once gone through, the skeins or linen were exposed on the grass for two or three weeks; and it was boiled and bucked a second time, and then again washed, and exposed to the action of the sun as before. These operations were repeated four or five times; and every time the bucking was performed, the alkaline lixivium was reduced in strength. At the end of these repeated operations, the yarn or linen was steeped in sour milk, and allowed to remain in it till the scum broke; and then it was taken out and subjected again to bucking, washing, and crofting, as exposing linen on the grass is called, till it came to a good colour, or appeared perfectly clean. These alternate boilings, sourings, and bleachings, were necessary to enable the oxygen of the atmosphere to act on the colouring matter, and to prevent either the alkali or the acid from remaining in the cloth, as either of these would injure its texture. By alternately using them, they neutralize each other, and the salt, which resulted from their combination, had no bad effect. In washing the cloth or the yarn, soap was always employed, as it cleaned the goods more effectually, and made them softer.

In Holland, a piece of linen was steeped in a lixivium, in which other cloth had been steeped; it was then exposed to the action of a new ley, poured on it boiling hot, in which it was left lying eight days. It was then thrown into butter-milk, and trod on by the feet for a considerable time; more butter-milk and more cloth were subsequently added, till the tubs were nearly filled. Pieces of plank were then laid over the linen, and it was subjected to a considerable pressure. In six or seven days the cloth was taken out, and if it were not white enough, it was again steeped, as above described. It was afterwards washed with soap and clear water, wrung dry by means of a machine, and spread out to bleach.

This method was so tedious, that if the first operations were begun in March, the process was not completed before September; and thus the people who sent linen from Scotland to Holland to bleach, did not get it back till the month of October. Cloth put in at Midsummer, was only half bleached that year, and was finished the following spring. The first great improvement in this process, was substituting diluted sulphuric acid for the sour milk, which was suggested by Dr. Home, about the middle of last century. One souring, which, when done with milk, required from two to six weeks, may be as effectually accomplished with sulphuric acid in 12 or 18 hours. The acid, also, is not subject to putrefaction like the milk, and is not only more efficacious, but produces a better white, without in the least injuring the linen. Dr. Home kept linen in diluted sulphuric acid for several months, and at the end of that time the cloth was as strong as when it was first put in. By the introduction of this acid into the art, the process was shortened more than three months,

and a prodigious saving of labour produced. The next important improvement, which has, in fact, brought bleaching to a high state of perfection, was the employment of oxymuriatic acid: but we must reserve our account of it for our next Number.

MANUFACTURE OF RUSSIA LEATHER.

The raw ox-hides are first laid in running water, or in large tan-pits full of water, dug in the earth for that purpose, to soak for a whole week, but in summer not so long. During this time, they are daily taken out of the water and scraped at a scraping bench, or wooden horse. Having now been duly steeped, they are put into a ley, which is prepared as follows:—

In other vats, likewise dug in the ground, and under cover, they mix two parts of good ashes with one part of unslaked lime, in boiling water, and sink the wet hides in this ley, on a grating, which being suspended by cords, can be raised or let down at pleasure. In this vat the hides are laid again, for about a week, though in warm weather not quite so long, and in cold weather a little longer. The test of the hides having lain long enough in the ley is, that the hair can without difficulty be rubbed off with the hand, so that none remains. If the hides, after the expiration of a week, are not in that condition, fresh ashes are put into the ley, and the skin sunk into it; but if at length the hair be sufficiently loose, the hides are entirely taken out of the ley, and all the hair scraped off on a stretching-block, by means of blunt iron scrapers, with two handles. The hair is well cleaned by washing, and is sold for domestic purposes. The hides, thoroughly cleaned from hair, are suspended in vats of clean water, or in a running stream, where they remain three days, diligently turning them to and fro, in order to purge them from the ashes and ley; afterwards they are hung up and left to drain. The hides must now be scraped on the flesh side; to this end they employ either the usual scraping iron, or other irons, sharper in various degrees. After this treatment the hides are trampled. Calves' hides have another sort of preparation. This preparation is made of white excrement of dogs, dried, which is dissolved in boiling water, and to a hundred hides about seven gallons of dried excrement is the proportion. Much nicety is required in tempering this with water, and the object is the complete freeing of the skin from the salts that adhere to it from the ley. These hides remain here 48 hours. With this solution of excrement is stirred a sour gruel of oatmeal with warm water, and between six and seven gallons of dregs of sour small beer are put in the thin gruel, that it may sour quickly with the hides. To each hide the tanners allow about four pounds of oatmeal.

After the hides are well soured, which is done in large vats, they are laid in other vats, and well steeped for two or three days in a strong tan-juice, thoroughly boiled from good bark. When this is done the hides are brought straight to the tan. In the tan-pits, in which often some hundred hides are lying, is poured half water and half tan, or water boiled with tan, and a grating is hung in with cords, having one hide after the other spread upon it, thick strewed with good fine pounded tan, and the grating constantly let deeper into the pit, till it be nearly full, yet so that the tan liquor is always above the hides, which is then again sprinkled over with tan. In this tan the hides continue to lie a week, those of full grown animals longer. On being taken out they are washed and trampled on, which two workmen in a summer's day can perform with 300 hides. Next day they are laid in the same manner in fresh tan. Thus the hides generally get four times successively fresh tan, and are every time rinsed clean. In the last tan they lie three weeks or longer, and are then finally washed, hung up,

and, when they have tolerably drained, delivered to the workmen whose business it is, in particular workshops, to dye, dress, and wax the hides, and finish them.

The tanners seldom use oak tan. The choicest tan is that of the *black willow*, and also the young bark from other shrubby willows, which is dried and brought to market. The proportions of tan are regulated by circumstances; but the excellence of Russia leather does not altogether depend upon the tan, for in some parts of Siberia, where there are no oaks and but few willows of any size, the hides tanned with birch bark are little inferior to those tanned with the willow bark. The bark is ground in ordinary tan-mills, driven by water-wheels or horses, or, where these are wanting, it is pounded with wooden pestles and mortars by day-labourers.

The most common mode of colouring the skins, is by sewing them together in pairs, while they are yet moist, round the edges, with rushes or strips of bark, the hair side inwards, thus forming them into a bag or sack. The colour is put into this sack, which is well shook, and the superfluous dye suffered to run out: the skins are then dried. By another process, much time and trouble are saved in this operation, besides preserving the edges. Each skin is hung upon a horse, over a long trough, so that the hair side, which must be stained, appears outwards. Dye is then poured upon it out of the dye-kettle, until the whole skin is dyed. The two colours generally given, are red and black. The red dye is prepared by pounding Brazil (sandal) wood in the mill or water pestles, as fine as tan, and boil it in kettles. The skins, previous to dyeing, must be steeped in alum water. To each skin, if small, half a pound of logwood is put, and a pound to larger skins: but the larger skins are mostly stained black. The Brazil wood is also used for the black dye; but in the red dye, to a hundred skins three pounds of good iron vitriol are dissolved. After the first tincture, the skins are dried, and afterwards, on tables, done over again with the same dye, and rolled up, that they may thoroughly imbibe the dye. This tincture is sometimes repeated three times to heighten the dye. When the skins are now tolerably dry, by hanging with the flesh side outwards, the skins, still somewhat moist, are smeared over on tables, that have ledges with birch tar, which gives the peculiar smell which is so much prized by foreigners. The skins are now cleaned from any impurities that may remain, and are then sent to the dressing-house, where skilful workmen scrape them with scraping-irons, having two handles, with the edge crosswise on a stretching-bench, till a soft thin leather remains, with a clear glossy surface, free from all impurities. Other workmen then take the cleaned skins to large clean tables, and sprinkle them on the flesh side with a gentle shower of fresh water from their mouths, and lay them slightly rolled up to moisten. Thus finished, the skins are taken separately, one after another, folded together, and worked and calendered in all directions, to make them soft and pliant. They are now curried with a kind of wooden comb, with sharp irons fixed in leathers, like a card for carding wool, the skin being folded with the hair side outwards, by which the whole surface acquires the cross strokes or trellis-like marks they are always seen to possess. Some work the skins with the hands first dry, not sprinkling them till they are mangled with the card; and, lastly, those skins which are too harsh and stiff to the feeling, are, more or less, sprinkled with linseed oil, and are now fit for the merchant. The chequered impression is sometimes given with cylinders, a foot long, and three inches in diameter, wound round with a multitude of wires, and weighing three or four hundred pounds.—*Beausobre,* tom. i. p. 246.

TO MAKE LIQUID PHOSPHORUS.

The best method of preparing liquid phosphorus is as follows:—Heat very gently, for two hours, one part of phosphorus with six of oil of almonds. The oil thus charged with phosphorus must be kept in a bottle, well corked. It may also be prepared by rubbing in a mortar one part of phosphorus with one sixteenth of sulphur and ten parts of oil of almonds until a perfectly homogeneous mass is obtained, and then adding gradually more oil to effect a solution.

AN ANCIENT METHOD OF PROMOTING COMBUSTION.

We willingly insert the following letter; but must request some of our Correspondents to favour us with an explanation of the phenomenon mentioned. In the present state of our information, we are bound humbly to confess that we are not aware of the principles on which the *poker* operates; but we are inclined to suppose them electrical rather than chemical. Till we have obtained a little more knowledge on the subject, we beg leave to remind our Correspondents of an anecdote of Charles II. It is said that this king, who loved laughter better than wisdom, sent a message to the members of the Royal Society, requesting that learned body would explain the cause why a dead salmon was heavier than a live one. Immediately the *wits* of all those sages were set to work. One wrote a treatise and another an essay. One said the life of the fish was a principle of levity, and justified his assertion by the manner in which it jumped out of the water; another, that the parts were more closely compressed together after death, though he acknowledged there was some difficulty in accounting for the flesh becoming soft; in short, they were nigh quarrelling before they could agree on the report to be made to his majesty. At length it came into the head of one of them, that something might be learned of the cause by ascertaining the extent of the effect; accordingly, *a live* salmon was procured and weighed, and it was also weighed after the principle of life was extinct, when, alas! it was found that the witty king had only wished to have a laugh at his learned servants, for the live salmon was as heavy as the dead one. We need scarcely ask our Correspondents, after this, to ascertain to what degree the poker promotes combustion.

"*Monday, March* 22, 1824.

"Sir,—A few admirers of your little Publication, "The Chemist," met the other day, and had a warm dispute as to the nature of the effects produced by the poker being placed across the fire, in producing a more rapid combustion; and after contending the point ardently but unsatisfactorily, we determined on submitting the case to you, and an explanation of which will greatly oblige, Sir,

"Your humble servants,
"P. D.
"J. T.
"J. S.
"R. T."

DALHINE,

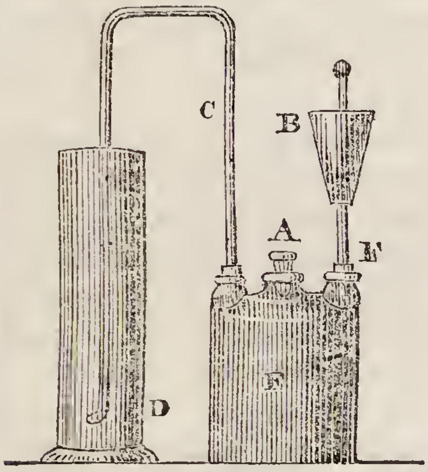
A NEW VEGETABLE SUBSTANCE.

Mr. Payen has discovered a new vegetable substance in the bulbs of the dalhia, which he calls "Dalhine."

To extract the dalhine, the pulp of the bulbs is to be diffused in its weight of water, filtered through cloth. The liquid is then to be mixed with 1-20th of its weight of common chalk, boiled for half an hour, and filtered. The residuum of the bulbs is now to be pressed, the solutions united and evaporated to 3-4ths of their volume; four per cent. of animal charcoal is then to be added, and the whole clarified with the white of an egg. This liquor, filtered and evaporated till a pellicle is formed on the surface, deposits "Dalhine" on cooling. All the washings are to be treated in the same way, and thus four per cent. of "Dalhine" will be obtained from the bulbs.

This, when pure, is white, in-

odorous, pulverulent, tasteless, sp. grav. 1.356; it is more soluble in hot than cold water, not soluble in alcohol, but precipitates from it in aqueous solutions. Potash dissolves it, but ammonia does not. Sulphuric acid converts it into an uncrystallizable sugar. — *Ann. de Chim.* xxiv. 209.



A MODE OF PROCURING CARBONIC ACID GAS, WITHOUT THE AID OF THE PNEUMATIC TROUGH.

Carbonic acid gas, which is usually obtained by the aid of a pneumatic trough, and the use of mercury, may be procured, so as to be subjected to experiment, by the following means:—Take a long glass tube, bent at right angles, C, connect it with the three-necked bottle, A, and insert the other end in the jar, D, till it reaches near the bottom. This jar must be perfectly dry, and placed with its mouth upwards. Put pounded marble and muriatic acid into the bottle, F; the muriatic acid combines with the lime, which is one of the constituents of the marble, and sets at liberty the carbonic acid, which is the other constituent, and which, rising in gas, and passing into the jar, D, will, from being heavier than the atmospheric air, expel it and take its place. After a short period, the bottle will be filled with carbonic acid gas. If a lighted candle is then let down into this gas, it will be instantly extinguished. As an amusing experiment, another jar may then be taken, rather smaller than the first; place in the bottom of it a lighted taper, and pour the contents of D into this jar, (taking care first of all to remove the tube, C, and to separate the bottle, A,) in the manner water is poured, and the taper will be immediately extinguished. That carbonic acid gas is heavier than common air may be shown by placing a large funnel of paper in a scale with something to counterbalance its weight in the other; then pour into the funnel the air from the jar, D, and the descent of the balance will show this gas is heavier than the atmospheric air. To show that carbonic acid gas is absorbed by water, fill a bottle or jar with this gas, and let it stand over water for some hours; an absorption will gradually take place, till at last none of the gas remains; and this absorption may be made more rapid by agitating the water. Water thus exposed to the action of carbonic acid gas, may be made to absorb rather more than its own bulk, and when thus saturated, it acquires a brisk and pleasant taste. If a forcing-pump be used, a still larger quantity of this gas may be made to combine with the water; and to preserve it, the water must be enclosed in strong stone bottles, and well corked. It is the presence of this gas which gives the sparkling appearance and briskness to champaign, cider, perry, soda water, and other liquids. They are brisk in proportion as the quantity of carbonic acid gas combined with them is great; and as this gas is a product of fermentation, they will also be flat and insipid if that has wholly ceased before they are bottled for preservation.

TRANSACTIONS OF THE CAMBRIDGE PHILOSOPHICAL SOCIETY.

We are happy to hear that "Cambridge is decidedly in an improving state;" though this testimony is borne to its merits by a Review, every writer in which is a Graduate of that University. Less impartial evidence might have raised some doubts of the assertion, particularly when accompanied by such a proof as is contained in the Transactions of the Cambridge

Philosophical Society. If the improvement has taken place, it has certainly not preceded the necessity for it; and we trust the sister University will follow the example of Cambridge, and that both will at length pay up some of those vast arrears they are indebted to the public, in science and useful knowledge. "To be serious," as the Review says, for its mirth is about as grave as our own, the Transactions of the new Philosophical Society do not, in our opinion, form a very striking proof of the correctness of the knowledge now in vogue at Cambridge, whatever they may of its being better than before. It is not our intention to go through these Transactions, because *reviewing* is not our *craft;* and we have only noticed them for the sake of observing, that whatever credit may belong to Professor Farish, who is lauded to the skies for his other inventions, he possesses none for the *Isometrical* instrument attributed to him. It is now upwards of three years since we saw an instrument to answer all the purposes described by Mr. Farish, constructed on the same principles, and designated by the same name. Of this, however ignorant Cambridge Students and Graduates may be, the learned Professor must have been informed, for the inventor of the *Isometer* is a person quite as well known to fame as Professor Farish. After all, we do not observe that he lays claim to the invention; and probably it is only the indiscreet zeal of a partisan, which has unduly ascribed it to him.

DAMP WALLS.

The following is another method recommended to prevent the effect of damp walls upon paper in rooms:—Line the damp part of the wall with sheet-lead, rolled very thin, and fastened up with small copper nails. It may be immediately covered with paper. The lead is not to be thicker than that which lines tea-chests.—*Mechanics' Magazine.*

CHEMICAL EFFECT OF THE AIR RESPIRED BY THE LUNGS.

Half fill a wine-glass with fresh prepared lime-water or barytic-water, and breathe into the fluid for a few minutes by means of a tobacco-pipe or a glass tube. The lime-water will speedily become turbid, and a white precipitate will fall to the bottom of the glass. The reason of this is, that carbonic acid gas is expired from the lungs, and combines with the lime in the water, forming sub-carbonate of lime, which not being soluble in water, is precipitated.

TO CORRESPONDENTS.

We cannot precisely answer the question of Electriatas as to the "BEST" *mode of making the instrument in question; but we will in the next Number insert his request, and from among the answers we shall receive, he may select that which pleases him best. In future, we have to beg he will pay the postage of his communications.*

The communication promised by A Young Chemist *will be acceptable: we should readily accept the other part of his offer, but that we happen at present to be busy with other experiments, and to have no time to devote to the investigation of the substance he alludes to.*

*** Communications (post paid) to be addressed to the Editor, at the Publishers'.

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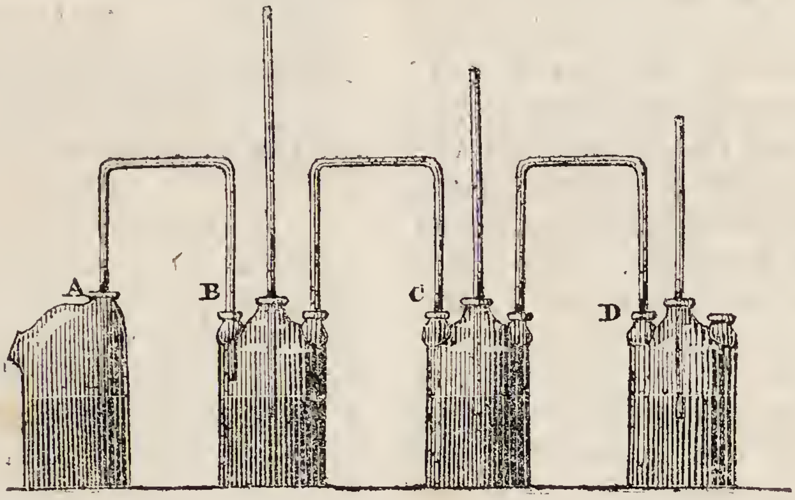
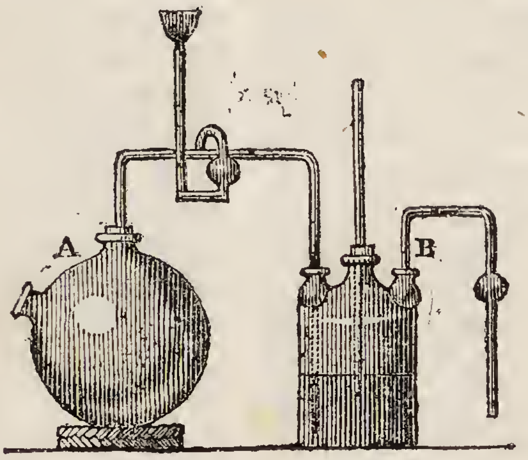
The Chemist.

"—— Search, undismayed, the dark profound
Where nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. V.] SATURDAY, APRIL 10, 1824. [Price 3*d*.





CONTENTS.

CHEMICAL APPARATUS.

Description of the Plates.

We here present our readers with the more ancient form of Woolfe's apparatus. Our last Number contained a description of the principles of this apparatus, and the uses to which it is put. A is the first bottle with which the retort is connected, and the communication is made from bottle to bottle by tubes, bent at right

angles. The upright tubes are tubes of safety, and the use of them, which we believe we omitted to explain in our last Number, is to guard against that reflux of fluid which might happen from a partial vacuum arising from condensation in any of the bottles; for as the air is expelled at the beginning of the operation, and its place supplied by vapour which is liable to condense, the consequence is, when any condensation takes place, the water being more pressed on by the atmospheric air without than by the gas within, passes backwards from one bottle to another, by rising through the tubes, as from D to C, and from C to B, and the different portions are mingled together. The tubes of safety prevent this; for if any such partial vacuum takes place, the atmospheric air is forced through the small quantity of liquid in which they are immersed, and rising into the bottles, preserves the equilibrium. One defect of this apparatus is, that we cannot have the advantage of immersing the tube which comes from A, into the liquid in B; for as it is destined to collect the condensable product, and ought therefore to be without water, it can have no tube of safety; and hence, if the tube issuing from it dip into the liquid in the second, whenever condensation happens, from the gas ceasing to be produced, the liquid will pass backwards into it. To obviate this, what is called the tube of safety of Welther was adopted. It is represented in Fig. 2. It consists of a bent tube, with an additional curvature and a spherical ball. Into this a small quantity of water is put, so as to rise, when the pressure without and within is equal, about half way into the ball. If the elasticity is increased in the internal part of the apparatus, by the production of gas during the distillation, the water is pressed upwards to the funnel at the top; if there is a condensation, it is forced by the atmospheric pressure into the ball; but whenever it has passed the curvature beneath the ball, it is obvious that a portion of air must rise through it, and will pass into the globe or bottle to the tube of which it is adapted, and preserve the equilibrium. This tube is inconvenient in its form, liable to be broken, and does not admit of great pressure. But with this improvement the apparatus now described is not so safe, nor so serviceable as the adaptation of this apparatus described in our last Number.

ANALYSIS OF SCIENTIFIC JOURNALS.

ANNALS OF PHILOSOPHY FOR APRIL 1824.

(*Continued from p.* 37.)

There is a great proportion of original Articles in the Annals for this month, which continues to sustain its reputation. Article I. is a communication by a Mr. Crichton, of Glasgow, "*On Expansions, particularly on those of Glass and Mercury.*" These two substances being used to make almost all the instruments by which we measure the expansive powers of other bodies, it is of the highest importance, as far as regards scientific research, that their expansive power should be most accurately determined. Accordingly, experiments for this purpose have been made at various times by very celebrated mathematicians and Chemists, such as Roy, Smeaton, Deluc, Lavoisier, and La Place; and particularly by Messrs. Dulong and Petit, in 1818, whose memoir on this subject obtained a prize. Mr. Crichton's observations are particularly directed to the experiments of the latter gentleman. The mode those gentlemen took to ascertain the expansive power of mercury, was to notice what quantity of it was expelled by subjecting it to the boiling temperature in glass vessels; but in these calculations, according to Mr. Crichton, they omitted to take into account the degree in which the glass itself expanded during the experiment.—"To learn the true dilatation," says Mr. Crichton, "we have only

to recollect, that whatever quantity is expelled from a vessel by a given increase of temperature, something more would be expelled if the vessel itself did not expand; and this supposed portion must be added to the quantity expelled at the higher temperature, (as found by experiment,) and deducted from that then remaining in the vessel, that each may represent what it would be if the vessel were not liable to expansion." Mr. Crichton then gives a concise general algebraic formula, for the estimation of this dilatation in all vessels; but, concise though it be, we must decline inserting it here on account of its length.

Art. II. is by Dr. Thomas Thomson, and contains a corrected expression for the "*Atomic Weight of Boracic and Tartaric Acids.*" We confess we do not see the utility of, or the real knowledge gained by ascribing to one body a certain proportionate property in relation to some other body, which is quite unknown. What should we think of a geographer who should pretend to instruct his pupils by telling them Paris was four times as far from London as Dover, and Rome fourteen times, if neither the geographer nor the pupils knew, nor could possibly know, what distance Dover was from London? Would not this be darkening knowledge by words, pretending to explain that which was unknown by some other thing equally unknown? The persons who, with such an amusing gravity, go about calculating the comparative weight of atoms, the very existence of which is unknown, must either have a very strange idea of what knowledge consists in, or a very strong propensity to detect harmony in apparent proportions. We shall pass by the Atomic Weight of Boracic and Tartaric Acids, with merely saying, that according to Dr. Thomson's corrected account, the weight of the former is represented by 3.0, and of the latter by 8.25. We have less even to say of Art. III., which is a Table of "*Corrections in Right Ascension of* 37 *Stars;*" those who want to consult it must necessarily have recourse to the Annals.

Art. IV. is "A contribution to a more accurate knowledge of Uranium," by I. A. Arfwedson. Translated from the Transactions of the Swedish Royal Society. First, Mr. Arfwedson says that the oxide of this metal, which had been operated on by preceding Chemists, was probably not pure; and then he shows—

HOW THE PROTOXIDE OF URANIUM MAY BE OBTAINED IN A STATE OF COMPLETE PURITY.

Finely pulverized pechblende is dissolved, by means of a gentle heat, in a mixture of nitric and muriatic acids. When the decomposition of the mineral is completed, and most of the acid expelled, a little muriatic acid is to be added; after which the liquid is to be diluted with a good deal of water. The sulphur, silica, and a portion of the gangue remain finally undissolved. A current of sulphuretted hydrogen gas must now be passed through the liquid as long as any precipitate falls, which is at first dark brown, consisting of sulphurets of copper, arsenic, and lead; and last becomes yellow, consisting of sulphuret of arsenic. Let the liquid be filtered and digested with a little additional nitric acid, to peroxidise the iron which remains. By this process the liquid is changed from light green to yellow. Carbonate of ammonia now added in excess takes up the oxides of uranium, of cobalt, and of zinc, but leaves oxide of iron undissolved. Should the solution contain a portion of earth, it will be separated with the oxide of iron. The filtered solution is then boiled as long as carbonate of ammonia is disengaged. A portion of the oxide of cobalt remains in the solution, which acquires a faintish reddish colour, but another portion of it is precipitated along with the oxide of uranium and the zinc. The precipitate is collected on the filter, washed and dried. It is then heated to redness, by which it changes from yellow to dark green;

and next macerated for some time in dilute muriatic acid, which dissolves the oxides of cobalt and zinc, with a small portion of the peroxide of uranium. Pure protoxide of uranium remains undissolved. If the muriatic solution be precipitated with caustic ammonia in excess, we obtain oxide of uranium combined with oxides of cobalt and zinc. From 38½ parts of pechblende treated in this way, Mr. Arfwedson obtained 25 parts of protoxide of uranium, being 15 parts less than the quantity stated by Klaproth. Mr. Arfwedson then describes the experiments he employed to reduce the oxide to the metallic state, and to determine its proportions, from which he infers that 100 parts of protoxide are composed of 96.443 of uranium and 3.557 of oxygen. He afterwards describes a number of experiments he made on some of the combinations of this metal, and their results, which are not interesting enough for us transcribe.

Art. V. is by the same author, and is "*An Examination of the Oxidum-Manganoso-Marganicum, a hitherto unknown chemical Compound of the Protoxide and Deutoxide of Manganese.*" We are afraid that the influence which the alchymists formerly exercised over science is not yet wholly extinct; at least we know no other way but supposing this to be the case, of accounting for the great passion we observe at present among Chemists, particularly among the continental Chemists, to make new artificial compound substances, and to devote a large portion of time to their rigid examination. We do not say such pursuits are wholly useless, but we would warn our readers against employing much of their time in them, unless they have a pretty strong presumption that the compounds may be of some use in the arts, or may serve to illustrate the science. The latter effect may be the consequence of Mr. Arfwedson's researches, and, as such, we may hereafter perhaps give an outline of them, but must now pass them by with this slight notice.

Art. VI. is an "*Account of a New Mineral,*" which the author of the Paper, a Mr. Levy, proposes to call *Babingtonite;* and of which Mr. Children, in Art. VII., describes the examination by the blow-pipe, and shows it to contain, but in what proportions is not mentioned, silica, iron, manganese, and lime, and probably a small proportion of titanium. Art. VIII. is Astronomical Observations, by Colonel Beaufoy, which, in this instance, are of not much importance. Art. IX. is a good collection of the mean results of several meteorological tables kept at different places, and terminated by the following observations:—The mean annual barometrical pressure of 1823, notwithstanding the amount of rain and snow which fell being nearly unprecedented, and which for the last three years has been rapidly increasing, was greater than for many years past. The mean annual temperature shows that wet summers are generally cold ones; and the average of the year is 2½ degrees below ordinary years. The winds in 1823 were of the same description as those of 1822.

Art. X. is "*On the Effect of transmitting the Electrical through other Fluids,*" by Mr. C. Woodward. This Paper details—

A CURIOUS ELECTRICAL EXPERIMENT,

Which we shall give, omitting Mr. Woodward's explanation, that our readers may have a greater opportunity to exert their own talents. "Place," says Mr. Woodward, "a piece of glass on the table of the universal discharger, and bring the pointed wires nearly in contact upon the surface of the glass; over the intersection formed by the wire strew some gunpowder, and pass through it the charge of a jar concontaining about a square foot of coated surface, when it will be found that the powder will be invariably dispersed without inflammation.

"Take a glass tube, six or eight inches long and about a quarter of an inch in diameter, fill it

with water, and insert a cork at each end; through the corks pass pieces of wire, so as to form a conducting communication with the water; place some loose gunpowder on the glass of the universal discharger, as before; insulate the tube, and let it form part of the circuit; pass the charge through the water, and the gunpowder will be inflamed. I then," says Mr. Woodward, " pasted on a board, about three feet long, a narrow slip of tin-foil, in which, at equal distances, four intersections, of about one eighth of an inch, were made. I insulated the board, and placed over one of the intersections some loose gunpowder, and over each of the others, six or seven wafers. On transmitting in the common way a charge through the tin-foil, the powder was scattered, and the wafers blown three or four feet from the board, but on repeating the experiment with a tube of water, the powder was inflamed, and the wafers remained without any perceptible motion." Mr. Woodward then states, that he found the powder was inflamed in proportion as the tube was filled with a substance which was not a good conductor. Thus, if filled with ether or alcohol, the powder was set on fire; if filled with sulphuric acid, which is a better conductor, the powder will be blown away, and scattered without catching fire. " But the most remarkable circumstance attending these phenomena is, that it is immaterial whether the tube form part of the circuit before the electrical fluid passes through the gunpowder or afterwards. If the tube be placed on what I will call the negative side of the powder, for the sake of distinction, either in immediate contact with the coating of the jar, or in any part of an interval in twenty yards of chain, the powder will be invariably inflamed when the charge is passed."

Art. XI. being " Hints," are probably only understood by the Reviewer to whom they are addressed; at least, neither this article nor Art. XII., " On the Crystalline Forms of Artificial Salts," has any interest for us. Art. XIII. is an analysis of the salts, the crystals of which are described in Art. XII. Art. XIV. is " On a Submarine Forest in the Frith of Tay," &c., and has been transferred to the pages of the Annals from the Transactions of the Royal Society of Edinburgh. We shall hereafter imitate the Annals, and take a part of this interesting paper into our own pages. The remainder of the Annals is taken up with Analyses of Books and Proceedings of Philosophical Societies.

TECHNICAL REPOSITORY FOR APRIL 1824.

We intended to add here an analysis of the contents of this work; but on examining it attentively, we found nothing worth quoting; and to give the number and headings of the articles would be only copying the dullest part of a dull journal.

MANUFACTURE OF SHAGREEN.

Shagreen is prepared only in the province of Astracan, by Tartars and Armenians.

Horse hides and ass hides are taken; but properly no more than the hinder back piece is useful to this purpose, which is cut off immediately above the tail, in nearly a semicircular form, about an *arshine* and a half above the crupper, and rather less than an arshine along the back. From long experience, the rest of the horse hide is found to be unfit for shagreen, and is thrown away. The back pieces thus cut out, are laid in a vat filled with clean water, and left in it several days successively, till they are thoroughly soaked, and the hair comes freely off. Then the hides are taken, one by one, out of the vat, spread against a board set slanting against the wall, one corner of the hide reaching over the edge of the board, where it is fastened; and in this position the hair is scraped off with a blunt scraper, and with the hair the upper pellicle, and the cleansed skin is laid again in clear water to soften. This done, they take it a second

time out, spread one piece after another in the manner described, scrape now the flesh side with the same scraping-iron, and the whole skin is cleaned again on the hair side with great care, so that nothing now remains of the softened skin but the clean fuzzy web which serves for parchment, consisting of thick fasciculi of mellow fibres, resembling a hog's bladder softened in water. After this preparation, the shagreen makers take in their hand certain frames, composed of a straight piece and a semicircular bow, and therefore nearly of the shape of the skin, which is stretched on it, with strings, as even and uniform as possible; and during this operation, it issprinkled between whiles with clean water, that no part of it may dry and occasion an unequal extension. In like manner, they finally wet them when all the stock of skins is stretched, and carry all the thoroughly wetted skins into the work-room. There the frames are, one by one, laid flat on the floor, so that the flesh side of the stretched skins is turned undermost. The other side is now thickly strewed over with the black, very smooth and hard seeds of a species of the herb goose-foot, or the greater orach, (*chenopodium album*) and which grows in great abundance, and almost to man's height, about the Southern Volga, in farm-yards and gardens; and that these may make a strong impression on the skin, a felt is spread over them, and the seeds trod in with the feet, by which means they are impressed deeply into the very yielding skins; then, without shaking off these seeds, the frames are carried again into the open air, and set leaning against a wall to dry, in such manner that the sides covered with the seeds face the walls, and cannot be shone on by the sun. In this situation the stretched skins must dry for several days successively in the sun, till no trace of moisture is perceptible in them, and they may be taken out of the frames. Then when the impressed seeds are beaten off from the hair side, it appears full of little pips and roughnesses, and has got that impression which the grain of the shagreen ought to produce, when the true polish has been given to the skin by art, and the ley now to be mentioned has been used previous to the straining. The polish is done on a stretching-bench, or a board on tressels furnished with a small iron hook, and covered with some thick felts, or flakes of sheep's wool, on which the dried shagreen may lie soft. This is hung in the middle by a hole, which has been occasioned by a string in the stretching, to the hook, and fastened at the end by a string, with a weight or a stone, by means whereof the skin is allowed to move to and fro, but cannot easily be shoved out of its proper situation. This done, the polishing or rasping is performed by two several instruments, the first being an iron crooked at one end like a hook, and sharpened; with this the surface of the shagreen is scraped pretty sharply, in order to remove the most prominent rugosities, which, from the horny hardness of the dried skin, is no easy matter, and in which great care must be taken, not to shave away too deeply the impressions of the orach seeds, of which there is imminent danger, if the iron be kept too sharp As the blade of this iron is very narrow, it will make the shagreen rather uneven, and therefore, after it the other scraper must be used; whereby the whole surface acquires a perfect equality, and only a slight impression remains of the seeds, exactly as it ought to be. After all these operations, the shagreen is laid again in water, partly for rendering it supple, and partly to make the elevations appear. The seeds having caused pits in the surface of the skin, the interstices of these having lost their prominent substance by polishing or shaving, and the points that were pressed down having lost nothing of their substance, now spring up above the shaved places, and thus form the grain of the shagreen. To this end the pieces of shagreen are left to soften 48 hours in water, and are floated several times afterwards

in a strong and hot ley, which it receives by boiling from an alkalescent saline earth (schora) found about Astracan. From this ley the skins are bundled warm on another, and thus suffered to lie some hours, whereby they swell up and are softened in an extraordinary manner. Again, they are left to lie 24 hours in a moderately strong brine of common salt, by which they are rendered fine and white, and excellently adapted to receive any agreeable colour, which the workman hastens to give them, as soon as they are come out of the pickle. The colour most commonly communicated to the fine shagreen is the sea green, as the most beautiful. But the expert shagreen makers have the art of making also black, red, blue, and even white shagreen.

For the green dye, nothing more is necessary than fine copper filings and sal ammoniac. As much of the latter is melted in hot water as the water will dissolve. With this sal ammoniac water the shagreen skins, still moist from the brine, are brushed over on the ungrained flesh side, and when they are thoroughly wetted, a thick layer of copper filings is strewed over them, the skins doubled together, so that the strewed side lies inwards; then each being rolled apart in a little felt or locks of wool, they lay all these rolls orderly on one another, and press them equally by a considerable and uniformly pressing weight, under which they must lie 24 hours. In this time the sal ammoniac water dissolves enough of the cupreous particles for penetrating the skin with an agreeable sea green colour; and though it be not strong enough the first time, yet a second layer of copper dust, wetted with sal ammoniac water, with which the skins must lie again 24 hours, will be quite sufficient for staining them thoroughly, when they may be properly cleaned, laid out, and dried. For giving the blue colour to shagreen, they use only indigo, which, to this end, is not so prepared as for the silk and cotton dyers, but entirely without bones, only by a strenuous friction it is mingled and dissolved with the other ingredients. They put about two pounds of finely grated indigo in the kettle, pour cold water on it, and stir it till the dye begins to dissolve. They next dissolve it in five pounds of pounded *telakar*, which is a sort of barilla, or raw soda salt, burnt by tbe Armenians of Kisliar, and a worse kind by the Kalmucks, adding two pounds of lime, and one pound of virgin honey, all thoroughly stirred, and set in the sun for several days, during which time the stirring is frequently repeated. The shagreen skins which are to be made blue, must be put only in the natron ley, (schora) but not in the brine made of common salt. They are again folded up wet, and sewed close together round the edges, with the flesh side turned inwards, and the shagreened hair side outwards, upon which they are three times dipped in succession in an old store dye-kettle, at every time pressing out the superfluous dye. Lastly, they are all brought into fresh dye, which must not be pressed out, and with which the skin is hung up in the shade to dry. They are for the last time cleaned, ornamented on the edges, and reduced to order.

(*To be continued.*)

COAL TAR.

THE undermentioned substance may perhaps be worthy of the attention of some of our readers: other avocations prevent us at present doing more than inserting the letter.

To the Editor of The Chemist.

March 29, 1824.

SIR,—There is a substance obtained on distilling coal tar, the properties of which have never, to my knowledge, been examined. It is called by the workmen employed in the gas works, "Fat," and by the generality of Chemists, "Naphthaline." It is found in the neck of the retort. It is a brown substance, very much in appearance like the pyrolignite of lead of commerce, and of a very disagreeable smell. On subliming, it is found in the head of the alembic, in white, plate-shaped crystals, which are very inflammable. I should

feel extremely obliged by your mentioning it in your useful little work, as it might induce some one to make experiments on it.

Yours, very respectfully,
A Young Chemist.

A DISCOVERY OF SIR HUMPHREY DAVY DISPUTED.

We are not at all disposed to think that the facts contained in the following letter, which we take from a valuable cotemporary Publication, at all diminish the merit of Sir Humphrey Davy. We even think they do not relate to the same mode of applying the tin, and we are certain, if they do, that the inventor could not at that period explain the *modus operandi* so as to carry a conviction to the mind of every Chemist, that the proposed method would be effectual. The galvanic agency, on which Sir Humphrey Davy's method is founded, though certainly discovered in 1791, was so little known for several years afterwards, that it is quite impossible Mr. Wyatt should have adopted his method from a knowledge of the phenomena of galvanism. Still the coincidence is striking, and serves to show that the most valuable discoveries may be blundered on by chance, and lost for want of a knowledge of their principles.

Sir Humphrey Davy's Remedy for the Decay of Copper Bottoms not original.

Skinner-street, March 29, 1824.

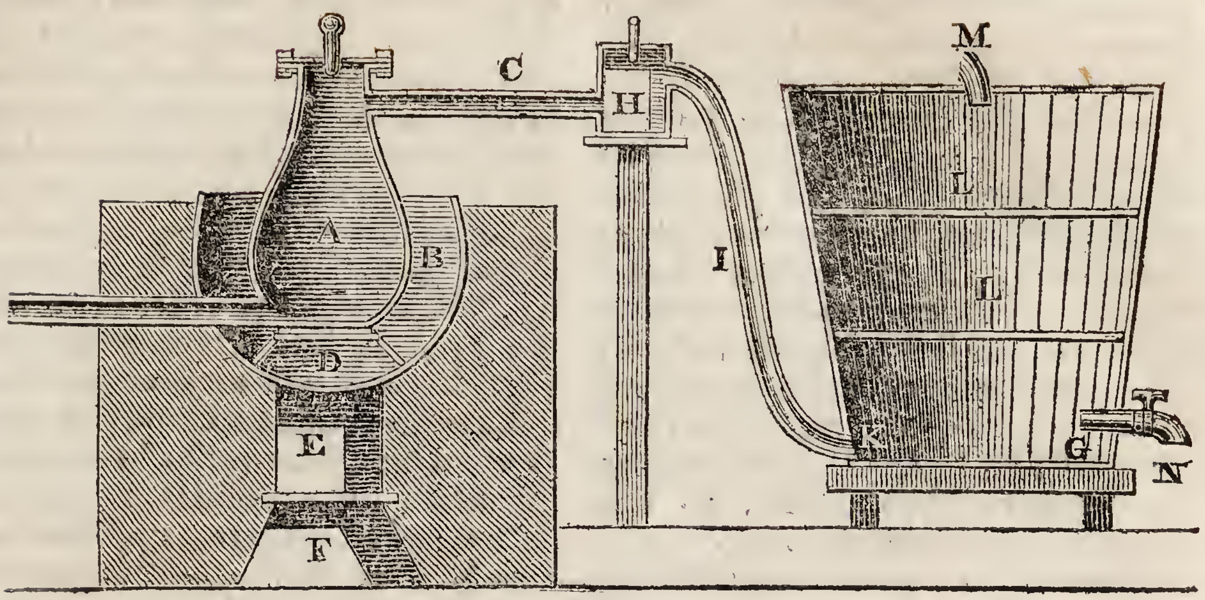
Gentlemen, — The following extract from an advertisement, inserted in a newspaper, entitled "*The World*," dated April 16, 1791, will, I trust, be thought worthy of a place in your valuable Magazine. While it confirms the efficacy of Sir Humphrey Davy's plan for preventing the corrosion of the copper sheathing of vessels, it shows, at the same time, that he had been anticipated in that discovery. The advertisement begins as follows—"By the king's patent, *tinned copper* sheets and pipes, manufactured and sold by Charles Wyatt, Birmingham, and at 19, Abchurch-lane, London;" and after umerating the many advantages which they possess, it goes on to say—"they are particularly recommended *for sheathing of ships*, as possessing all the good properties of copper, with others obviously superior, which the following extract, from a report founded on actual experiment, by Dr. Higgins, clearly demonstrates, viz., that this coating of tin powerfully resists the action of salt-water, and by preventing the corrosion of the copper, operates as a preservative of the iron placed contiguous to it." The dimensions and weight per foot are then mentioned, and the various purposes to which the invention is applicable.

I am, Gentlemen, yours, &c.
Samuel Deacon.

Mechanic's Magazine.

INFLUENCE OF SOUND ON ANIMALS.

In the human ear the fibres of the circular tympanum radiate from its centre to its circumference, and are of equal length; but Sir Everard Home has found, that in the elephant, where the tympanum is oval, they are of different lengths, like the radii from the focus of an ellipse. He is of opinion, that the human ear is adapted for musical sounds, by the equality of the radii; and that the long fibres in the ear of the elephant are the cause of its acuteness of hearing. A *piana-forte* having been sent on purpose to Exeter-change, the higher notes hardly attracted the notice of the elephant, but the low ones fixed his attention. The effect of the higher notes of the piano on the great lion at Exeter-change was only to excite his attention, which seemed very great. He remained silent and motionless; but no sooner were the flat notes sounded than he sprang up, attempted to break loose, lashed his tail, and seemed so furious and enraged as to frighten the female spectators. This was attended with the deepest yells, which ceased with the music. Sir E. Home has found a similar inequality in the fibres of the tympanum in neat cattle, horses, deer, hares, and cats.—*Phil. Trans.* 1823.



BLEACHING.
Art. III.
PRESENT METHODS.

We come now to describe the present mode of bleaching. The weaver, in preparing his work, after stretching the warp, gives consistency to the yarn, by smearing it with a paste made of flour, or potatoes, boiled with water into a pap. This paste is applied with a brush; and, when dry, in order to make the warp smoother, the weaver then uses some greasy matter: generally, he employs tallow, which he rubs on the yarn in an unequal manner. It has been recommended, that the weavers should employ soft soap for this purpose, which would save the bleacher a great deal of trouble, and, of course, make the cloth wove without the addition of tallow of more value to him. There is a great deal of difficulty in getting this grease thoroughly out of the cloth; and very often it remains in spite of every exertion, and causes spots, to the great injury of the cloth. It is obvious, that the weaver has no interest in using soap instead of tallow, unless the bleacher gives him some more money for cloth, in weaving which soap has been employed in preference to tallow; and it is, therefore, his business, if this suggestion be an improvement, to encourage the weaver in carrying it into effect. The first operation of bleaching is to remove from the cloth the substances added to it by the weaver, which is partly done by washing it for some hours. In the large manufactories, both in Scotland and Lancashire, this is done by a mechanical contrivance, of which there are two sorts: one is called the wash-stocks; the other consists of a dash-wheel and squeezers. The latter method is now most generally adopted. In the wash-stocks the cloth is alternately beaten by stout pieces of wood, and turned round till the whole has received sufficient cleansing. The dash-wheels are water-wheels, the inside of each of which is divided into four compartments, with a hole in each for putting in the linen, and several smaller holes for the free admission and egress of the water. As the wheels revolve, the cloth alternately rises and falls, while it is exposed to the action of a running stream. This method is found to answer very well, but cannot be adopted where water is not plentiful, as the wheel revolves much too fast to be used as a moving power. After the cloth has by washing been freed from any loose dirt it can carry off, it is put into a circular vat, called a kieve, which is filled with alkaline ley, at a blood heat, that has been already used for bucking linen. In a few hours a motion takes place in the liquid; its temperature increases, bubbles of air rise to the surface, and a thick scum is thrown up. This process is a species of acetic fermentation, and is completed in from 12 to 18 hours, according to

the state of the weather. After it is over, the cloth must be instantly removed, and again washed, or the putrefactive fermentation would begin, which would injure its texture, and would fix the colouring matter beyond the power of art to remove it. The bleacher must, therefore, take great care to watch this part of the process, and not allow the steeping to be continued too long. After the cloth has been steeped and washed, it undergoes the process of bucking, as described in our last Number.

After it has been bucked six, seven, or eight times, the practice being different at different places, and washed and exposed as often on the field, it is soured, or allowed to remain for one night in diluted sulphuric acid; it is then again bucked, washed, and exposed on the fields, and afterwards immersed for twelve hours in oxymuriate of potash, or of lime. This is the most important part of modern bleaching, the part in which it most differs from former practices, and which is considered to be the greatest modern improvement. The remainder of the present Article will, therefore, be confined to a description of this part of the process.

Oxymuriatic acid gas was discovered, as we stated in our last Number, (Art. Chlorine) by Mr. Scheele; but it was the celebrated French Chemist, M. Berthollet, who first thought of applying it to bleach cloth. In 1785 and 1786, he made a number of experiments with this view, and explained to the world, in several papers, its effects on colours, and in what manner it might be employed in the arts. In the year 1787, a knowledge of these experiments, and of their application, was obtained in England; and Messrs. Milne, of Aberdeen, and the celebrated Mr. Watt, were the persons, particularly the latter, who introduced the use of this substance into our bleaching-fields. There is some doubt as to which of these gentlemen was the first to import this art from the continent; but a difference of a few weeks or months cannot depreciate the merit to which both may justly lay claim, for neither was at the time acquainted with the labours of the other. The speed, however, with which they had appropriated the discovery of Scheele, and the experiments of Berthollet, turned out of great advantage to the country. Scarcely had Mr. Watt got the process into order, when two French Chemists applied to Parliament to obtain an exclusive right to vend and use a liquid of their invention for whitening linen and cotton; and their application, which, had it been successful, would have secured a monopoly of this process to them, was defeated, by Mr. Watt being able to prove that it was already publicly known and publicly practised. The application of the same parties, at a later period, to obtain a patent for a bleaching liquid, was defeated by Mr. Henry, of Manchester, one of the first improvers of bleaching in this country, who proved, that the composition of their bleaching liquid was not a secret, for giving up which they deserved to be paid.

When first brought into use, the oxymuriatic acid was employed exclusively in the state of gas. The articles to be bleached were suspended in boxes or chambers, into which the gas was conveyed, but which were capable of holding water; and to prevent the goods being injured by the gas, they were frequently let down into the water. This was both an inconvenient and insufficient practice; for the goods were not equally exposed in all parts to the gas, and were not, therefore, equally bleached, and the fumes were peculiarly noxious to the workmen. But it was soon discovered that water might be made to absorb this gas, and by this means acquire all its bleaching powers. The first bleaching liquid made, consisted of water impregnated with the gas. In 1789, it was further discovered, however, that by the addition of potash to the water, it imbibed the gas sooner, and formed a more concentrated, though not so efficacious a solution. It had this great advantage, how-

ever, that it did not part with the oxymuriatic acid gas so readily to the atmosphere as the water did, while it did give up the gas to the cloths; and thus it bleached them without being disagreeable to the workmen and injurious to their health. In a short time the oxymuriate of potash was generally used, and continued in use till it was superseded by a cheaper article. In 1798, Mr. C. Tennant, of Glasgow, discovered that the alkaline earths, such as barytes, lime, and others, might be united with the oxymuriatic acid as well as potash, and serve the same purpose. At first he effected this union in water; but afterwards succeeded in combining the gas with the lime in a dry state, and thus made it portable at a small expense. The oxymuriate of lime is the substance now principally employed in bleaching; and lime is preferred to potash because the former is a much cheaper commodity. The mode of preparing either is this:—

Our plate represents a leaden retort, A, set on a tripod of iron, D, in a cast iron boiler, B, which is built into brick work, and has a common furnace and ash pit, E F. The top of the retort is closed by a leaden cover, with screws and nuts; loose flax dipped in white lead, which has been ground in oil, is spread about the joinings, and the whole can be firmly screwed together. In the top of the cover there is a hole fitted with a leaden plug, adapted for putting the materials into the retort; and when the apparatus is prepared for working, the plug is hammered into the cover, and is luted with a little soft clay, to prevent the escape of the gas. C is a leaden tube to convey the gas, and H is a vessel from 12 to 18 inches in diameter, intended to prevent any impurity from descending by the tube, I, into the receiver, K L L, which is made of lead, or wood lined with lead, when much work is to be done. It is covered at top, having a hole at M, for introducing water, and a stop-cock, N. Fill K, supposing it to contain 120 gallons, with a solution of caustic potash; or, if the oxymuriate of lime is to be prepared, with water, in which 28 pounds of common salt have been dissolved, and add to it 56 pounds of quick lime, in an impalpable powder; put 21 pounds of common salt, mixed with 14 pounds of black oxide of manganese, the mixture being moistened with water till it is of the consistence of moist dough. The top of the retort must then be carefully screwed on. Then pour 8lbs of diluted sulphuric acid with as much water into the retort, by the hole at C, and plug it up immediately; oxymuriatic gas is instantly disengaged, and passes into K, where it is absorbed by the caustic potash, or by the lime-solution. This distillation is usually begun in the evening, and the work is permitted to go on through the night without any interference. In the morning, the same quantity of sulphuric acid, diluted with the same quantity of water as before, is added, when more gas is disengaged. As soon as it is observed that the production of gas diminishes, the water in the boiler, B, is heated, which again promotes the separation of the gas, and it is kept boiling as long as any gas passes into the receiver. The bubbling noise which it there makes is the mark the workmen have for guiding their operations. When finished, the solution of the oxymuriatic acid and potash, or lime, may be drawn off at the cock, N. If lime be employed instead of potash, the liquid in the receiver is kept constantly agitated during the whole process. The liquid thus obtained is the bleaching liquid, into which we have stated, as the last step in our description, the cloth was immersed for 12 hours; it is afterwards boiled twice and washed, and then soured and washed. The linen is then rubbed over with strong black soap, and is afterwards well washed in pure spring water. It is then carefully examined, and if found fully bleached, is blued and made up for the market; and if not fully bleached, is again dipped in the

oxymuriatic acid, again soured, boiled, and washed till it is perfectly white.

CHEMISTRY AS A SCIENCE. Art. V.

IODINE.—FLUORINE.

Iodine was accidentally discovered in 1811 or 1812, by a Mr. de Courtois, a manufacturer of saltpetre at Paris. In the course of his operations for procuring soda from the ashes of sea weeds, he found his metallic vessels much corroded, and in endeavouring to find out the cause of this, he discovered *iodine*. After ascertaining some of its properties, he gave a quantity of it to Mr. Clement, a celebrated Chemist, who undertook to examine it, and in December 1813, communicated the result of his researches to the French Institute. The inquiry into its real nature and properties was immediately prosecuted with great ardour in France by M. Gay Lussac, and in England by Sir Humphrey Davy and other celebrated Chemists. From their numerous experiments, it has been concluded that iodine is a simple substance, resembling chlorine in many particulars. Like it, certainly it has no other claim to the character of a simple substance but the fact of its having hitherto resisted all the efforts of the most celebrated Chemists to decompose it. We know of no important part it performs in nature's works. It seems of no value to art, and is not necessary to life. It is *made* by the Chemist, though it is beyond his art to *unmake* it, and there are only a very few substances from which he can make it. "But," says an eloquent and enthusiastic Chemist, "for a circumstance nearly accidental, one of the most curious of substances might have remained for ages unknown, since nature has not distributed it either in a simple or compound state through her different kingdoms, but has confined it to what the Roman satirist considers as the most worthless of things, the vile sea weed." This is no longer a very correct assertion, for iodine has been lately found by Mr. Fuchs in the water of a salt spring at Junthal, in the Tyrol, which discovery has been confirmed by M. Buchner. M. Angelini also has detected iodine in large quantities in the mineral water of Sales, in the province of Voghera, in Piedmont.—(*Bulletin des Sciences, Physique, et Mathematics, Feb.* 1824.) It is probable also that it is contained in several, and perhaps in all saline waters; but even admitting that it is much more diffused than we are at present aware, we must repeat that its only claim to the character of an elementary substance is, that it has hitherto resisted all the efforts of the Chemist's art to decompose it.

Iodine may be obtained in the following manner:—Reduce a quantity of kelp to powder, and digest it in water till every part of the kelp which is soluble in that liquid is dissolved. Filter the solution, and evaporate it till it no longer deposits crystals of salt. Pour the remaining liquid into a clean vessel, and drop into it a little sulphuric acid, to separate the sulphuretted hydrogen and muriatic acid, which are often present. It is then to be evaporated till a dry mass only remains, which is to be put into a retort, and half its weight of sulphuric acid poured upon it. A purple coloured vapour arises, which becomes more abundant on applying a moderate heat, and a black substance, in scales or in minute crystals, condenses on the neck of the retort or in the receiver; this substance is iodine. It may be rendered quite pure by again distilling it from a little weak solution of potash. If kelp be used for making soap, the waste ley of the soap-makers affords iodine in as large quantities as a solution of kelp.

Iodine thus procured is a solid substance of a greyish black colour, and of metallic lustre, having some resemblance to black-lead. It is usually in the form of scales, but it may be obtained in crystals. It has a disagreeable smell, similar to that of chlorine, but not so

strong. Its taste is acrid, and leaves a pungent hot sensation in the mouth. When swallowed by M. Orfila it produced heat, constriction of the throat, nausea, and salivation; and dogs were killed by a dose amounting to 70 grains. It possesses, therefore, poisonous qualities. Like chlorine, it destroys vegetable colours; but it acts with much less intensity. It stains the hand yellow, but the stain soon disappears. It melts at the temperature of $224\frac{1}{2}$ of Fahrenheit's thermometer, and rises in vapour at the temperature of $351\frac{1}{2}$. In the state of vapour, it has a very beautiful violet colour, from which it was named iodine, or, like a violet. It is nearly insoluble in water, more soluble in alcohol, and still more in sulphuric ether. It can be made to combine with various other substances, and these compounds will be afterwards mentioned.

Fluorine. — In 1771 Scheele published a set of experiments on *fluor spar*, a well-known beautiful mineral, called, in this country, Derbyshire spar, in which he showed that this mineral was a compound of lime and a peculiar acid, to which he gave the name of fluoric acid. It was long supposed that this acid was a compound of oxygen with an unknown base; but in 1810 an opinion was started, that it was like the muriatic acid, having hydrogen for its base, and combined with some unknown substance, which is a supporter of combustion; and this unknown substance, from its supposed analogies to chlorine, has received the name of *fluorine*. This supposition is now generally adopted by Chemists, under the authority of some experiments made by Sir Humphry Davy, from which he drew this conclusion. All attempts, however, to obtain fluorine in a separate state have been quite fruitless, and no evidence whatever but suppositions can be offered of its existence. As we do not conceive this to be the place to make our readers acquainted with the singular properties of *fluoric* acid, the only substance in which fluorine is supposed to exist, we must necessarily be silent, for we hold it a most vain employment, and a mere waste of our time and the time of our readers, to occupy ourselves in describing the properties of substances which are only supposed to exist.

NEW WATER MORTAR.

It has been announced in all the scientific journals and daily papers, that a Mr. Vicat, a Frenchman, has discovered, that powder of chalk heated, between six, and not above thirty minutes, on a plate of iron red hot, acquired the property of hardening under water, when mixed into a stiff paste. It would appear, from the experiments of Mr. Vicat, that this property, as far as it goes, is the consequence of only half burning the chalk. He adds, in a late Number of the *Annales de Chimie et de Physique*, that chalk being rich lime-stone, he might have generalized his conclusions and extended them to all lime-stones; but the number of failures he has met with in the course of his experiments, has made him more cautious; and the facts which he proceeds to detail justify his forbearance. "It is now four months," he says, "since my specimens of chalk, prepared in this way, were immersed in water, and placed in my laboratory, where the temperature never falls below 52°, and they are now in the same state as they were twelve days after the immersion. A blunt knitting-needle does not produce any sensible effect on them, but a sharp one, pushed with a slight degree of force, easily penetrates them without bending. An excellent water mortar of the ordinary species, placed under the same circumstances as the chalk, was not penetrated by the needle, which bent in place of entering it. But water mortar cannot be called good, which, at the end of four months, is in a state resembling that of chalk." He goes on to recount other experiments which he has made, and which by no means warrant the interpretation put on

them by some journalists. He concludes thus:—" These experiments are far from confirming the general results which have been announced; and I find it difficult to believe that good mortar will ever be obtained by the imperfect calcination of pure lime-stone. It will, probably, be necessary again to have recourse to lime-stone in which some portion of clay is mixed."

FRENCH FIRE.

SUCH of our readers as give implicit credit to the following amusing extract, may, perhaps, set about discovering the lost fire of M. Dupré:—

"A person of Dauphiné, by name Dupré, having passed his life in the study of chemistry, and in making experiments in that science, invented a sort of fire, so rapid and so powerful, that it would be impossible to avoid or extinguish it; water even increased its activity. Experiments of its effects were exhibited in the presence of Louis the Fifteenth, upon the canal at Versailles, and in the arsenal at Paris, and others in some of our ports, which made even the most intrepid among the military shudder. When it was well ascertained that a man, in possession of such an art, might soon destroy a fleet or burn a town, without its being in the power of any human assistance to stop the progress of the destruction, the king strictly forbade Dupré to communicate his secret to any one, and gave him a recompense to remain silent. The king was at that time, it must observed, much embarrassed with being engaged in an unfortunate contest; but he could not bear the idea of increasing the miseries necessarily attendant on war, he chose rather to run the risk of a continuance of his misfortunes. A glorious example, well worthy the imitation of all sovereigns who may be placed in similar circumstances. Dupré is dead; and has, it is universally believed, carried his fatal secret with him to the grave."

TEST TO DISTINGUISH IRON FROM STEEL.

To distinguish iron from steel by a chemical process, take nitric acid, dilute it with so much water, that it will only feebly act upon the blade of a common table knife. If a drop of the acid thus much diluted be put upon steel, and allowed to remain on it for a few minutes, and then washed off with water, it leaves a black spot. But if a drop of the same acid be put upon iron, the spot will not be black, but of a whitish grey colour.

Steel is iron combined with carbon. The black stain is owing to the conversion of the carbon of the steel into charcoal, which thus becomes predominant; and iron being nearly free from carbon, produces only a grey stain.

The utility of this test is not confined to finished articles manufactured of steel, but its application enables the workmen in iron and steel to ascertain also the quality and uniformity of texture of unfinished articles.

IMPERFECT SIGHT.

IN the Royal Society, on Feb. 19th, a paper was read by W. H. Wollaston, M. D. V. P. R. S. on the semi-decussation of the optic nerves, which contained the following curious statements:—

" After fatigue arising from four or five hours violent exercise, Dr. Wollaston was affected by a partial blindness, of which he first became sensible by seeing only half the face of a person near him, and next, by seeing only the termination " *son*," of the name " *Johnson*." His blindness was to the left of the point of vision in each eye; it was not perfect darkness, but merely a dark shade, and in about 15 minutes it gradually passed off in an oblique direction, upwards, towards the left. Some years afterwards Dr. W. again experienced this singular kind of blindness, without any obvious cause, and first became sensible of it, likewise, by seeing only the half of a person's face; but in this case the right side of both eyes was affect-

ed, and complete vision was suddenly restored by the joy produced on receiving information of the safe arrival of a friend from a hazardous enterprise. Dr. Wollaston has a friend who has experienced the same kind of affection for seventeen years past whenever his stomach is deranged. Another friend was attacked by pain at the left temple and at the back of the left eye, which was succeeded by this sort of blindness on the right side of each eye; he can see to write, see *the paper he is writing upon, and the pen he writes with, but not the hand that guides the pen.*"

The affection, in this case, Dr. W. fears, is a permanent one; the pain, he thinks, arose from some pressure on the brain, and the blindness is caused by a continuance of this pressure on the left thalamus nervorum opticum. From these facts Dr. Wollaston infers, that the opinion of the anatomists, of the left eye being supplied with optic nerves from the right thalamus, and *vice versa*, is unfounded, and that each eye is supplied from the thalamus on its own side.

A USEFUL TEST PAPER.

Boil a pound of red cabbage leaves, minced, in a pint of distilled water till all the blue colour is extracted; then strain the liquid through a cloth or sieve, evaporate the clear infusion to half its bulk, and pour it into a shallow dish. Into this concentrated solution immerse sheets of filtering paper, each of which will absorb two ounces of the fluid; and afterwards hang them up to dry. Acids change the blue colour of this test paper into red, and alkalies change it into green.

LUTHER'S COMPARISON OF CHEMISTRY.

The upright art of alchimie (said Luther) liketh me very well, and indeed it is the philosophie of the antient. I like it not only for the profit's sake, which it bringeth in melting of the metals, in excocting, preparing, and extracting, also in distilling herbs, roots, and in subliming. But also I like it for the sake of the allegorie and secret signification, which is surpassing fair; namely, touching the resurrection of the dead at the last daie. For like as in a furnace the fire extracteth and separateth that which is the best out of the matter, yea, it cometh upwards, the spirit, the life, the sap, and strength, so that it possesseth the uppermost part of the still; it cleaveth thereon, and then trickleth downwards, insomuch that the fat swimmeth above, and the best thereof hovereth always uppermost; but the unclean matter, or the dregs, is left at the bottom, like a dead carcass and worthless thing. — *Luther's Table Talk.*

DIVISIBILITY.

In some experiments on the transmission of light, recently made by Mr. Herschel, he employed plates of apophyllite, which are stated to have been so thin, that one of them did not exceed the 165,900 millionth of an inch, and the piece from which it was *sliced* weighed only sixty grains!—*Man of Letters.*

A BLEACHING LIQUID FOR FAMILIES.

Take three pounds of common salt and one pound of black oxide of manganese, mix them carefully together, and add as much water as will make them into a paste. Put the mixture into a retort, and add to it two pounds of sulphuric acid, previously diluted with four pounds of water. A gas will instantly arise, which is oxymuriatic gas, and must be received in an air-tight vessel containing four pounds of water, in which one pound of best American pearl-ash has been dissolved. The retort may after a short period be placed in boiling water, which will extricate all the gas which can be procured. The receiver may be made of wood, but should not be larger than to contain the quantity of water specified above.

SINGULAR ANALOGY BETWEEN SEALS AND FLIES.

In the Philosophical Transactions for 1816 it was demonstrated that the feet of the common fly are provided with cups, by which the animal is able to produce a vacuum wherever it places its foot, and thus to walk in opposition to gravity. By a paper lately read at the Royal Society, and written by Sir Everard Home, it appears that the hind feet of the walrus and seal are provided with a similar means of walking in opposition to gravity. The apparatus in the fly's feet was magnified 100 times, to make it distinctly visible, but that of the feet of the walrus was reduced to one fourth of its natural size, to bring it within the compass of a quarto plate. This discovery has, in fact, elucidated the structure of the fly's foot. In it there are two points, called pickers, the use of which was not before ascertained. Now Sir Everard has shown that two toes in the foot of the walrus, answering to those in the foot of the fly, are employed to bring the web closely down on the surface traversed, so as to enable the animal to form a more perfect vacuum, and the air is re-admitted on their being lifted up.

ANOTHER DELUGE COMING.

We are sure every person has remarked as peculiar, the torrents of rain which have fallen within these few years. Accurate meteorological tables, referred to in another part of our Journal, show that in 1823 the quantity of rain and snow which fell was nearly unprecedented, and that for the last three years the quantity which fell annually has been rapidly increasing. At the same time, notwithstanding such a quantity falling from the atmosphere, it continues to increase in weight, or be more and more surcharged with moisture. It is recorded in the same tables, that the mean annual barometrical pressure of 1823 was greater than for many years past. Already 1824 has begun streaming down upon us, as if it were determined not to be outdone by its watery predecessors; and we should be greatly alarmed for the result, if it had not been lately discovered that there is a huge central fire in the earth, which has only now begun to burn with increased activity. We know there are those who dreaded, when the discovery was lately made, of the great heat in mines, that we were soon all to be burnt up; but they must now see that it is another instance of that system of compensation which has been so much insisted on by M. Azais and other writers; and the fire is now only burning briskly to keep the earth habitably dry.

Timid people, indeed, among whom we do not reckon ourselves, may put a different interpretation upon it, and imagine, from the present calamitous state of the elements, that something more terrible is now to befal the human race than it ever before suffered; and that the unhappy beings of this generation are destined to be both drowned and burnt.

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The Chemist.

"—— Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. VI.] SATURDAY, APRIL 17, 1824. [Price 3*d.*

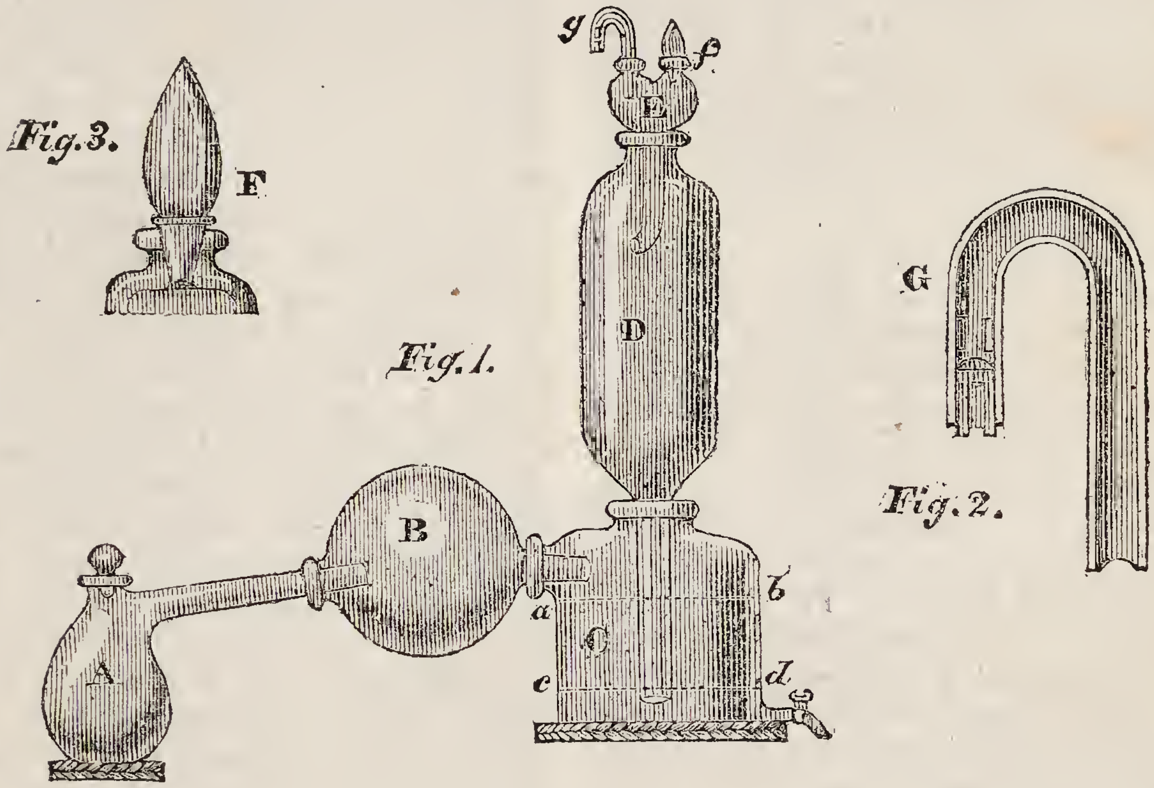

Fig. 3. Fig. 1. Fig. 2.

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IMPROVEMENT OF WOOLFE'S APPARATUS.

To the Editor of the Chemist.

SIR,—The above improvement of a very useful chemical apparatus, which was some time ago made by an ingenious young gentleman of the name of King, at Edinburgh, deserves to be generally known, and in the belief that it cannot be more so than through the medium of your useful little Journal, it is very much at your service. M.

In the common Woolfe's apparatus, in the bottle next the retort no liquid can be put; and even in the second one the tube of communication with the first cannot be made to dip into the liquor; and,

if in case of sudden absorption, the liquor should be brought once into the retort, the whole experiment is spoiled, or you run a risk of bursting the apparatus. The object of the improvement is to remove these evils; and besides doing that, this apparatus is much more simple and convenient than the common Woolfe's apparatus.

A is the retort; B the condensor for receiving the condensable products; and C, D, and E the respective receivers. The whole joinings are fitted by grinding, so that no luting is required. The retort is tubulated, and a stop-cock for drawing off the impregnated liquid is fitted to the receiver, C. C is filled with water or whatever there is to absorb the gaseous product up to the dotted line *a b;* and D and E are empty. When the gas comes over, it passes into, and is absorbed by the liquid in C; if the internal pressure be strong, that liquid is forced up to the dotted line in D, and beyond that into E; and if the pressure be very great, the superabundant gas can escape by removing the conical stopper *f*, (the form of which is shown by Fig. 3.) To the other aperture of E there is fitted a bent tube, *g*, with a valve opening inwards, (shown upon a larger scale by Fig. 2); and when absorption takes place, the pressure of the atmosphere forces air through this valve, and causes the liquid to descend into the receivers; but whatever be the degree of absorption, no liquor can get into the retort, if the whole quantity at first in C be so regulated as not to come up to the orifice at B. Hence the apparatus is free from danger, at the same time that the liquid is exposed to the action of the gas in the most effectual manner.

ANALYSIS OF SCIENTIFIC JOURNALS.

(*Continued from* p. 69.)

QUARTERLY JOURNAL OF SCIENCE.

In Number IV. of the "Chemist" we gave a specimen of the unhandsome manner in which the Quarterly Journal of Science reviews books; and in the present we observe a letter from Dr. W. Henry, whose work was also reviewed in that journal, claiming, as from his talents he justly may, "*to be animadverted upon with a reasonable share of courtesy and candour.*" In the next Number of this scientific journal we shall probably have a remonstrance from Monsieur Blainville, on the review in the present Number, of his work on "*fossil fish.*" Not having seen that work ourselves, we cannot say whether the Reviewer's quotations are correct or not; but judging from the reviews of Mr. Gurney's and Dr. Henry's books, and the review of M. Blainville's being written in the same spirit and for the same purpose, that of throwing ridicule on scientific statements, we should apprehend they cannot be relied on, and that geologists would run the risk of neglecting a work which might be of importance to their science, if they were to follow implicitly the opinions of the Quarterly. A journal which is thus unsparingly severe on others, can itself expect no mercy; and we might proceed without forbearance to comment on its contents. We might remark a great paucity in valuable original papers, and compare its own barrenness with its asperity to others. We might object to its spurious devotion to the trifles of one sect of scientific men, and its unmeasured scorn of the researches of others, as if there were bigotted parties in science as well as in politics and religion, and the Quarterly Journal were the organ of an Orange *Click*, headed by Sir Humphrey Davy, Dr. Wollaston, and Mr. Brande. We might implore these gentlemen not to allow any unprincipled man, by flattering them, to make the world believe they have accepted the unworthy dignity thus conferred on them, and that they lend themselves to the odious task of unmeritedly degrading others because he stands justly rebuked. We might,

we say, dilate on all these topics, but we prefer extracting from the Quarterly Journal the little information it contains, setting it, we hope, a proper example of doing what our feeble powers permit to promote the interests of science in preference to wounding the feelings of its professors.

Art. I. "On some phenomena relating to the formation of dew on metallic surfaces, by George Harvey, M. G. S., &c. &c.," gives an account of several experiments, instituted to confirm some facts relative to dew, which had been observed by Dr. Wells. Mr. Harvey exposed square pieces of gilt paper, spread over two pieces of wood formed into a cross, to the action of the atmosphere, and he found that where the metallic paper covered the wood no dew was formed, while the rest of the metallic surface was covered with dew. He found also, that a small piece of glass, when presented to a clear and tranquil sky, had its surface as readily covered with moisture as a larger piece of glass; but in case of metals, a large metallic plate is sometimes more readily dewed than a small one; and sometimes a large plate will preserve a whole night a bright and unsullied surface, while a small piece is wholly covered with dew. The first formation of the dew, it was remarked, took place at the corners of the portions of the metallic paper not in contact with the wood; and it was interesting to observe, during the progressive deposition of the moisture, that the particles were disposed in triangular forms, similar to the right angled triangles into which the metallic paper was divided by its contact with the cross. The parts of the paper in contact with the cross had no dewy particles on them, their junction with the wood appearing effectually to prevent the formation of moisture. Another remark of Mr. Harvey is, that silver metallic paper permits dew to be deposited on it sooner, and in greater abundance, than gold metallic paper. By other experiments he confirmed the observations of Mr. Six, that the temperature of short grass is always higher than that of long grass. The state of the herbage has always a considerable influence on the quantity of dew deposited, and the greater the body it presents, the more abundant it is likely will be the formation. It has been stated by Dr. Wells, that wool is one of the substances which is most productive of cold, and consequently when exposed to the action of the atmosphere, collects dew more abundantly than any other substance, a fact which was also confirmed by the observations of Mr. Harvey. There is perhaps in this paper too much of the dandyism of science, but it is on the whole very neatly written, and does honour to Mr. Harvey.

In Art. II. Mr. Swainson gives a minute description of "Two new and remarkable fresh water shells, one of which is a 'gigantic shell,' being 8½ inches in length, and 5¾ inches in breadth." This description, occupying four pages and a half, is a proof of the respect the Quarterly Journal has for trifles of some descriptions.

Art. III. explains that one cause of indistinct vision in optical instruments, is the admission of false lights, which the author, Dr. Goring, suggests a means of remedying. We again meet with Mr. Swainson in Art. IV., who takes up no less than ten pages of the journal with another description of some other shells, conchology being apparently at present the favorite science of the Quarterly Journal.

Art. V. "Account of the earthquake in Chili in November 1822, from observations made by several Englishmen residing in that country," is a neat and correct description, we are disposed to think, of that unfortunate occurrence.

Art. VI. "On Evaporation, by J. F. Daniell, Esq., F. R. S., M.R.I., &c." This gentleman is known to pay great attention to meteorology, and has put forth some peculiar theories, which he seems anxious

to support, and concludes his paper by endeavouring to show that the heat emitted by the condensation of atmospheric vapour would be sufficient to account for those expansions of the aërial currents to which he has, in his Essay on the Constitution of the Atmosphere, ascribed the fluctuations of the barometer. We should have thought the tunnel under the Thames was too hackneyed a subject for this scientific journal to discuss, but it does contain a paper on this subject, which makes Art. VII. We see nothing new in it, except a grave enumeration of the political advantages of the tunnel; among which are included a military pass and an under-water way to the Tower. It is also to facilitate communication between this great *point d'appui* of the national strength and the ports of Woolwich, Chatham, and Sheerness,--tending, of course, to protect the country from invasion. This is an advantage of the tunnel under the Thames nobody ever before thought of. We would recommend the right worthy projector to provide his tunnel with sluices, and bait it for the French army, when our navy is extinct, with all the treasure of London, and then he may have the glory of catching a few thousand men in his man-trap; and though not effectual to prevent an invasion, it may extinguish the invaders.

Art. VIII. "An account of the overflowing well in the garden of the Horticultural Society at Chiswick." As we know this mode of procuring water is an object of considerable interest to many people, we shall extract this description. In September 1823, Mr. Worsencroft began the operation of boring, and after boring five weeks without material interruption, tapped the spring on October 18th, and finally completed his task on the following day. The depth from which the water was brought was 317 feet, and the whole depth of the well, when completed, was 329 feet; the additional 12 feet of boring having been made in order to gain a perfect opening into the bed of the spring, which flowed when first tapped less copiously than after the final depth was reached. The chalk from which the water immediately comes is soft, but the bottom of the well is hard chalk. The water in all the neighbouring wells appears to have been obtained from about the same depth, and the strata through which the perforations were made, are nearly similar to those met with in the present instance. The tackle and instruments were very simple: a scaffold, twenty feet above the proposed orifice of the well, on which a platform was fixed to support a windlass, by which the rods used in boring were lowered into and raised from the well. These rods were of tough iron, about an inch and a half square, and ten feet long, the ends of each screwing on to, or unscrewing from the top of the next, as they are lowered into or raised from the hole. The instruments fixed, as occasion required, to the lower extremity of the series of rods, when in action, were augers of various dimensions for boring, steel chisels for punching, and a hollow iron cylinder, called a shell, fitted with a valve at its lower end, for drawing up soft mud. The rods, when an auger was attached to them, were turned round by means of moveable arms or dogs, which were made to lay hold of the part of the uppermost rod at the top of the hole. The auger being thus forced through the stratum of clay or sand, was drawn up as soon as its cavity was filled with the substance it had loosened. The chisels were employed for punching through stones or other hard substances. The rods, when these were attached, were moved by means of a powerful beam, acting as a lever, and worked by four men. The water is discharged at the surface of the ground, at the rate of six gallons a minute, and is capable of being carried twenty feet above the ground-level, and

then supplies a copious stream. The well is lined for the first 186 feet with cast iron pipes, having a three-inch bore; the succeeding 77 feet are lined with copper pipes, $2\frac{1}{2}$ inches in the bore, soldered into a single length, and resting in the chalk, through which the remainder of the hole is bored, and in which no pipes are used. The whole series of pipes were introduced at once, the hole having been prepared for receiving them as soon as it was ascertained that the augers had reached the chalk stratum. The land-springs in the gravel, above the blue clay, were kept out, in the first instance, by extra iron pipes. The spring which was found in the sand, below the blue clay and above the chalk, rose to within a few feet of the surface, but did not overflow. The whole of the water is, however, excluded from this well by the pipes with which it is lined. The cost of the well, including that of the pipes, boring, and all expenses, did not exceed 130l., and the manner in which it was executed was in every respect satisfactory. The principal impurity discovered in the water, by the action of re-agents, is common salt, of which it contains about $4\frac{1}{2}$ grains in the pint. When evaporated to dryness, the residue contains a sufficient quantity of carbonate of soda to render it manifestly alkaline; and this is also the case with the water of other deep wells in and about London. The remainder of the Articles in the Quarterly Journal are "Astronomical and Nautical Collections;" being tables, most of them equally as well adapted for an Ephemerides or Almanack as for a Journal.

Having at the commencement of our Analysis thought proper to make a few observations on the spirit which appears to prevail in the reviews at the end of this Journal, we cannot conclude without saying, that though they are written with asperity, and with evident illiberality, they cannot be denied the merit of vivacity and acuteness. The small articles of intelligence at the end of the Journal are collected with discrimination, and got up with considerable care and taste.

MANUFACTURE OF SHAGREEN.

(*Concluded from* p. 71.)

For the black shagreen, they employ nut-galls and vitriol, in the following manner:—The skins, still moist with the brine, are thickly strewed with finely pounded nut-galls, folded together, and laid one on another for 24 hours. In the meantime a new ley of bitter earth salts, or schora, is boiled and poured hot in little troughs or trays. In this ley each skin is waved to and fro several times, is again strewed with pulverized nut-galls, and again laid in heaps for some time, that the virtue of the galls may thoroughly penetrate the skins, which are then suffered to dry, and are beat out to clear them from the galls. When this is done, the skin is smeared on the shagreen side with mutton suet, and laid a little in the sun, that it may absorb the fat. It is the custom, likewise, with the shagreen makers, to roll up each skin apart, and to squeeze and press it against some solid body, in order to promote the absorption of the unctuous particles. The surplus is again scraped off with a blunt wooden scraper. This being done, and the skin having lain a little while, a sufficient quantity of iron vitriol is dissolved in water, with which the shagreen is rubbed on both sides, whereby it soon acquires a beautiful black colour; and now the edges and other defective parts are dressed.

To obtain white shagreen, the skin must first be steeped in strong alum water on the shagreened side. Having imbibed this, the skin is well rubbed on both sides with a paste of wheaten flour, and left to dry with it, and then all the paste is washed away with alum water, and the skin set to dry completely in the sun. As soon as the skins are dry, they are gently smeared over with clean melted mutton fat,

leaving them in the sun to imbibe it, and are worked and pressed with the hands, to promote this effect. Afterwards, the skins are fastened one by one on the above-mentioned stretching-bench, warm water is poured over them, and the superfluous fat scraped off with obtuse wooden instruments, to get rid of which the warm water just poured on has much assisted. By this process the shagreen receives a fine white colour, and needs only in conclusion to be dressed and rubbed. This whiteness is, however, given to the shagreen not so much that it may continue in that state, but in order to impart to it a beautiful high red hue, as this end could not be obtained to this perfection without that preparation.

But the shagreens intended to be stained red must not be brought out of the natron bitter salt ley into the brine, but must be made white in the manner above described, and afterwards supplied with the brine, in which they are left to lie about twenty-four hours or less, from the dye. The dye is made with cochineal, or kirmiss, as the Tartars call it. About a pound of the dried herb *tschagan*, which grows plentifully on the salt steppes about Astrachan, and is a sort of kali (salsola ericoides), is put into a kettle large enough to contain about four vedros of water, whereby the water acquires a greenish colour; the herb is then taken out, and about half a pound of grated cochineal put into the kettle, with which the above decoction must boil another full hour, diligently stirring it on the fire, that the kettle may not boil over. Lastly, to this are added 15 or 20 grains of the materials which the dyers called lutter, perhaps orpiment; let the dye boil a little more, and then take the fire from under the kettle. Then the skins taken out of the brine are laid separately in trays, pouring the dye upon them four times, rubbing it in with the hands, that it may be equally spread and imbibed, pressing it out every time, which done, they are ready for drying and ornamenting, and sell much dearer than the others.—*Pallas Neue Nord, Beytr.* i. p. 325.

The Kalmucks tan their leather with the dregs of their kirmiss, or with sour milk, smoke it a little, and afterwards rub it with scraped chalk. But the most laborious and ingenious of their productions are their leather vessels, which they make in the following manner:—The hides, as they come out of the water, are spread in the sun; then the women who are skilled in the business proceed to cut out pieces of the shapes necessary for the vessel to be made, sewing them together with the sinews of animals, and then drying them well in the smoke of a fire. In this manner they prepare not only vessels with large mouths, to which they give the form with their hands as the skin is drying, but also big bellied leathern bottles, for holding the kirmiss, and saddle flasks with a narrow neck, which, for giving them their shape, they keep incessantly blowing up with great patience, at first over the fire, and then filling them with sand or ashes, and ornament them on the outside with a variety of strokes and lines. They have even the art of making large leathern teapots, with a narrow spout, shaped like those in common use with us, in a very ingenious manner. In order to prevent the leather from becoming flaccid, and likewise dirty, by the hot water, these pots are smoked more strongly and for a longer time, an operation which lasts for several days, till at last they are as transparent as horn, and almost incorruptible. There are of the foregoing leathern bottles that hold five or six runlets.—*Ib.* vol. iii. p. 541.

ROPE BRIDGES OF SOUTH AMERICA.

The bridge over the Maypo (a river not far from Santiago, the capital of Chili) is curious from its simplicity, and from the close resemblance it bears to the chain bridges recently introduced into

England, to which in principle it is precisely similar. It consists of a narrow roadway of planks, laid crosswise, with their ends resting on straight ropes, suspended by means of short lines to a set of thicker lines drawn across the stream from bank to bank. These strong sustaining ropes are six in number, three at each side of the bridge, and hang in flat curves one above another; the short vertical cords which support the roadway being so disposed as to distribute the weight equally. The main or suspending ropes are firmly secured to the angles of the rock on one side, at the height of thirty feet from the stream; but the opposite bank being low, the consequent inclination is in some measure corrected, by carrying them over a high wooden pier, and attaching them afterwards to trees, and to posts driven into the bank. The clear span, from the pier on one side to the face of the rock on the other, is one hundred and twenty-three feet. The materials being very elastic, the bridge waved up and down, and vibrated from side to side, in so alarming a manner, that at the recommendation of the guide we dismounted and drove our horses, one by one, before us; neither man nor horse appearing, however, much at ease during the passage.—*Extracts of a Journal, &c. by Capt. Basil Hall, R.N.*

COW-TREE MILK.

Among the astonishing vegetable productions that are met with at every step in the equinoctial regions, a tree is found which yields in abundance a milky fluid, comparable in its properties to the milk of animals, and which is employed for the same purposes, as M. de Humbolt witnessed at the farm of Barbula, (Cordillere Litterale de Venezuela), where he drank some of the milky juice. The tree grows in considerable numbers on the mountains which command Periquito, situated to the north-west of Maracay, a village to the west of the Caraccas. The vegetable milk possesses the same physical properties as that of the cow, with the single difference, that it is a little viscid. It has the same taste in its chemical properties; it differs sensibly from animal milk.

It mixes with water in all proportions, and when thus diluted it does not coagulate by ebullition. The acids do not convert it into clots, as happens to cow's milk. Ammonia, instead of causing a precipitate, renders it more liquid. This character indicates the absence of caoutchouc. Alcohol occasions a feeble coagulation, or rather renders the juice more easy of filtration. The recent juice slightly reddens litmus. Its boiling temperature is the same as that of water. Exposed to heat, it exhibits at first the same phenomena as cow's milk. A pellicle is formed at its surface, which prevents the disengagement of aqueous vapours. On removing the successive pellicles, and evaporating it at a gentle heat, an extract is obtained resembling *frangipane*. When the action of heat is longer continued, oily drops are formed, which increase according as the water is carried off, and, finally, afford an oily liquid, in which a fibrous matter floats, which becomes dry and horny as the temperature of the oil is raised. Then is diffused the finest characteristic odour of meat frying in grease. By the action of heat, therefore, the vegetable milk is separable into two parts, the one fusible, and of a fat nature, the other fibrous and of an animal nature. If the evaporation of the vegetable milk is not carried too far, and if the fusible matter is not raised to ebullition, it may be obtained without alteration. It then possesses the following properties:—

It is of a white slightly yellowish colour, translucid, solid, and resists the impression of the finger. It begins to melt at 40° centigrade, and when the fusion is completed, the thermometer indicates 60°. Alcohol at 40° (sp. gr. 0.817) dissolves it totally by ebullition, and it precipitates on cooling. It saponifies with caustic potash, and

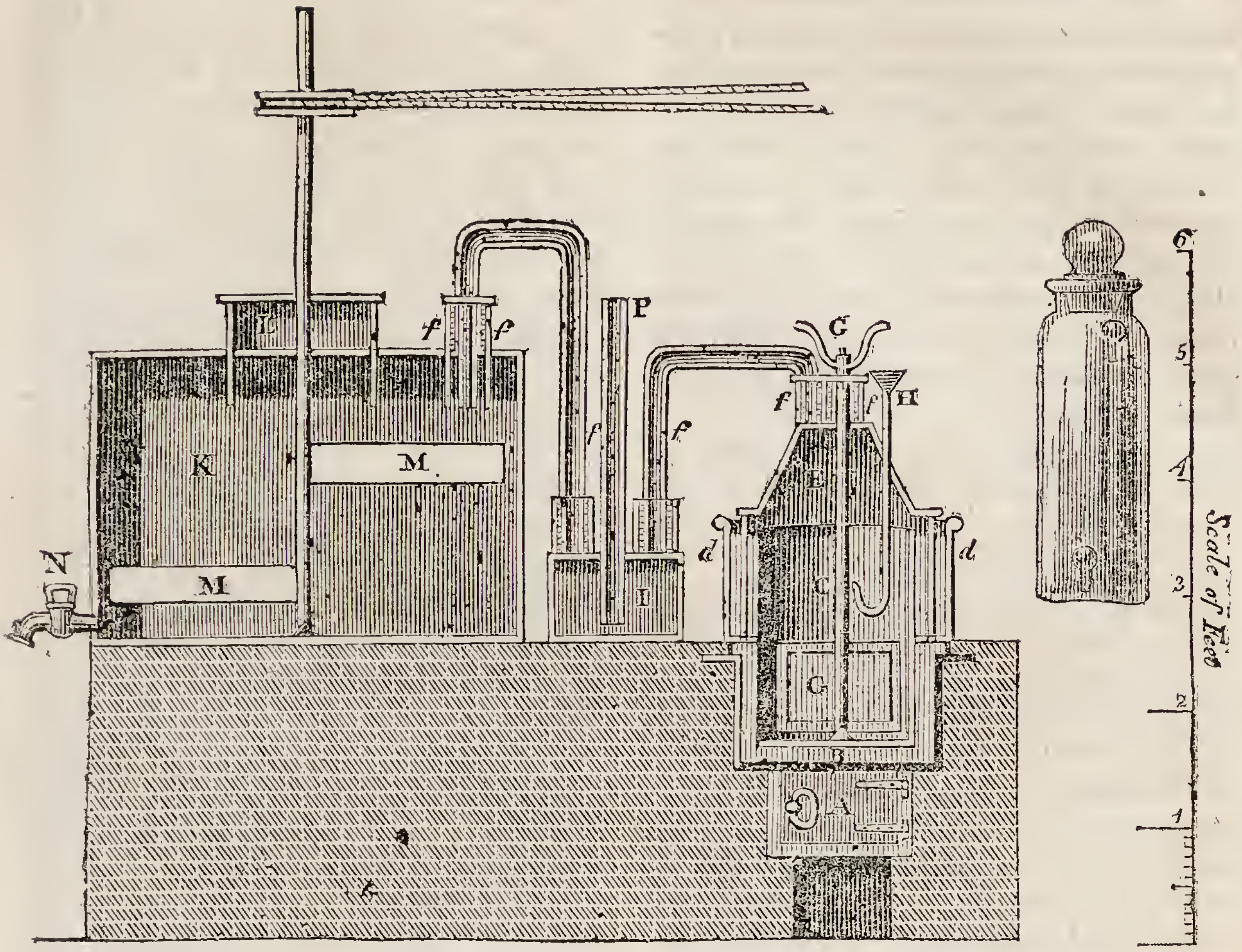
with ammonia forms a soapy emulsion. Nitric acid heated on it dissolves and converts it into oxalic acid. It resembles refined bees'-wax, and serves for making candles. The fibrous substance is procured by decanting the melted waxy matter, washing off the last portion of it with an essential oil, squeezing the residuum, and boiling it a long time in water, to volatilize the oil, the odour of which cannot, however, be completely discharged. Thus obtained, the fibrous matter is brown, having been somewhat altered by the temperature of the melted wax. It is tasteless. Placed on a hot iron, it twists itself and swells up, melts, and is carbonized, diffusing the smell of broiled meat. Alcohol does not dissolve it; and hence, by treating the extract of the vegetable milk repeatedly with hot alcohol, the fibrous matter is obtained white and flexible. In this state it dissolves readily in diluted muriatic acid. It possesses the same properties, therefore, as animal fibrine. Fibrine had already been found in the milky juice of the carica papaya, by Vauquelin. Besides these two main constituents, the vegetable milk contains a little sugar, a magnesian salt (not an acetate), and water. It contains neither *caseum* nor caoutchouc. By incineration some silica, lime, phosphate of lime, and magnesia were obtained. The wax forms about one half the weight of the milk.—*Annales de Physique et de Chemie.*

ATMOSPHERE OF SEAS.

M. Vogel, of Munich, after a number of researches, from which, judging by his name, (Bird) we should suppose him extremely well qualified, states, that—1st, the air of the channel between Dieppe and Havre contains muriates; 2dly, the air of the Channel, as well as the air of the Baltic, contains less carbonic acid than the air of the Continent; 3dly, the muriates do not disengage their acid at a temperature capable of bringing them to ebullition, but they are partly volatilised with the vapours of the water; 4thly, there is no particular colouring principle in sea air, as has been supposed; 5thly, all waters containing muriates acquire a wine red colour, with nitrat of silver, when exposed to the sun.

FIELD MICE.

In 1809 or 1810, in the month of August, there appeared such quantities of field mice in Morvern, that the inhabitants discovered these were more mischievous enemies than tax-gatherers or excisemen. They disappeared, however, during the ensuing winter, leaving the good people with an opinion, that it was better to have them for a few months than a few years. Every spot of fine pasture in the neighbourhood was cut into roads; the grass, bit through at the roots, lay withered on the ground; bushes, also, nibbled at the roots, decayed and died. The bark of young wood was knawed off, and the ground undermined to such a degree by their subterraneous residences, that it often yielded to the foot in walking. These subterraneous residences were intended for winter quarters; and it was observed the nests all communicated with each other by means of cross roads, and every nest had a connexion by one of these roads, with some place where there was water. At one farm in Morvern the crop was completely destroyed; every square foot of the *roof* of the barn was perforated, and the rods fastening the thatch bit through. The subsequent winter was very severe, and it is supposed they perished for want of food. These little animals did an immense deal of injury, destroying the young fir-trees, by eating away the bark a little above the root. So ruinous were they to the plantations, that an army of women and cats were stationed, night and day, so as to cover the whole domains of a Colonel Maclean from the incursions of this enemy. It would appear, however, that this force was insufficient; and, in spite of these sentinels, the Colonel's property was much ravaged.



BLEACHING.

Art. IV.

CONCLUSION.

Our papers on this subject have been hitherto confined to the more general practices of bleaching linen; in the present paper, the last on the subject, we mean shortly to advert to the bleaching of silk and wool, to bleaching muslin, and to that great branch of our domestic manufacture, bleaching cotton for calico printing. First, however, we have to give a little tabular view of linen bleaching, in which the quantity of linen bleached, and the quantity of materials employed, are precisely stated.

A parcel of goods, to which this table refers, consists of 360 pieces of what are called Britannias, each thirty-five yards long, and weighing on an average 10lbs., so that the weight of the whole is 3600lbs. After the first washing and fermentation, they are submitted to the following process:—

1. Bucked, with 60lbs. of pearl-ashes, washed and exposed on the field.
2. Ditto, with 80lbs. do. again washed, and exposed.
3. Ditto, 90lbs. potashes, washed, and exposed.
4. Ditto, 80...... do...... do.... do.
5. Ditto, 80...... do...... do.... do.
6. Ditto, 50...... do...... do.... do.
7. Ditto, 70...... do...... do.... do.
8. Ditto, 70...... do...... do.... do.
9. Soured one night in dilute sulphuric acid.
10. Bucked, with 50lbs. of pearl-ashes, washed, and exposed.
11. Immersed in oxymuriate of potash for 12 hours.
12. Boiled, with 30lbs. of pearl-ashes, washed, and exposed.
13. Ditto...... do...... do...... do.
14. Soured and washed.

By this process, 690 pounds weight of alkali is taken to bleach 360 pieces of linen; so that somewhat less than two pounds of alkali is employed for each piece. Some, however, of the pieces are found not to be fully bleached by this; and, therefore, two pounds may be stated as the average of alkali employed to bleach one piece of linen. The bleaching power of these substances depends on the quantity of pure alkali they contain; and this quantity, or their strength, is judged of by the quantity of an acid it takes to saturate them. The substances sold in commerce, under the names of potashes, pearl-ashes,

&c. are not, as is well known, pure alkali; it is, therefore, of great consequence to the practical bleacher, to know which substance contains the most alkali. The following, which is the result of numerous experiments, is given as the quantity of pure alkali contained in one hundred parts of the different alkaline substances met with in commerce and employed by the bleacher:—

Best American pearl-ashes	60 to 73
Caustic do. potash in reddish lumps	60 — 63
Second do. in grey lumps	50 — 55
Second do. pearl-ashes	50 — 55
White Russian pearl-ashes	52 — 58
White Dantzic do.	45 — 52
Alicant barilla	20 — 33
Inferior kinds of barilla	10 — 15
Natron	20 — 32

The quantity of sulphuric acid employed in making the sourings, varies in different bleaching-grounds. In Ireland the proportion of sulphuric acid to water, by measure, is stated to be as 1 to 640; while in Lancashire the proportion is as high as 1 to 46, or by weight, one pound of sulphuric acid to 25 pounds of water, the sulphuric acid being twice the weight of water. In some parts of Scotland the bleachers for calico printing employ even one measure of sulphuric acid to 25 measures of water; and it is sufficient to immerse the cotton five or six hours in this souring. No certain data can be given as to the strength of the oxymuriatic solutions, as they vary very much. The manufacture of sulphuric acid being conducted on a large scale for numerous other purposes, as well as bleaching, we we shall hereafter give a description of this.

The best Method of Bleaching Silk, according to M. Baumé, is this: on six pounds of yellow raw silk, placed in an earthen vessel, pour 48 pounds of alcohol, of the specific gravity 0.867, mixed with 12 ounces of muriatic acid, of the specific gravity 1.100. The silk remains in the liquid, which passes from fine green to a dusky brown, one day, and is then taken out, drained, and washed with alcohol. It is then infused a second time in the same mixture, for four or six days, and is then again washed as before. By this process silk may be made to surpass in whiteness and lustre, says M. Baumé, the finest specimens from Nankin; but the ordinary method is different from that recommended by this gentleman, and is as follows:—The raw silk is put into a bag of thin linen, and thrown into a vessel of boiling river water, in which good Toulon or Genoa soap has been dissolved. After boiling two or three hours, the bag being frequently turned, it is taken out, beaten, and washed in cold water. It is then wrung slightly, and again put into a copper with cold water, mixed with soap and a little indigo, whence it derives the bluish tint generally observed in it. It is afterwards wrung hard with a wooden stake, and then shook to separate the threads from one another. It is then suspended in a stove or chamber, constructed for the purpose, and sulphur is burnt under it, the vapour of which gives the last degree of whiteness to the silk.

Woollen Stuffs are thus bleached:—After coming out of the fuller's mill, they are put into soap and water, warm, in which they are again worked by the strength of the arms over a wooden bench; and by this means they acquire that whiteness which the fuller's mill had begun to give them. When sufficiently worked by the hand, they are washed in clear water and dried. This is called the natural method. Or the stuffs are thoroughly washed in river water, and when half dry they are stretched out in a close stove in which sulphur is burnt, the vapour of which diffuses itself over the whole stuff, adhering to it and giving it a fine whiteness. This is called Bleaching by the Flower, or Bleaching of Paris, because they use this method more in that city than any where else.

Muslins are thus bleached. The coarser kinds, after they have been steeped and washed, are first

boiled in a weak solution of pot and pearl-ashes, are again washed, twice boiled in soap alone, then soured in very much diluted sulphuric acid, washed from the sour, again boiled with soap, washed, and then immersed in oxymuriate of potash. Boiling with soap and steeping in the oxymuriate, are repeated until the muslin is a pure white; it is then soured and washed in pure spring water. In bleaching the finer muslins, such as *mull* and *book*, only soap, and no pearl-ashes, is used. There is a particular kind of cotton goods, called *pulicates*, the yarn of which is dyed with some permanent colours before it is wove. For a long time, no certain method could be found of bleaching the white of this kind of cloth, without injuring the colours. At length it was ascertained, that if the oxymuriate were neutralised by a considerable quantity of alkali, the permanent colours were rather improved than injured. Since this discovery was made, these cloths have been bleached in this way:—The starch is first well washed out in cold water, they are then boiled gently in a soap ley, and, after being washed, are immersed in a strong solution of oxymuriate of potash. This process is repeated till the white is good, when they are immersed in dilute sulphuric acid. If the goods are properly attended to, the colours are improved, and acquire a delicacy of tint which no other process imparts to them.

Another process of bleaching was introduced not long ago, by Mr. Turnbull, of Dunbarton, with great success, the principle of which consists in immersing the goods in a strong solution of caustic alkali, and afterwards exposing them to the action of steam in a close vessel. After being steeped in the alkaline solution, they are hung up in this vessel connected with a steam boiler. When the steam is admitted, the effects of the alkali are increased by the heat, so as completely to dissolve in a few hours the colouring matter of the cloth. They are afterwards washed, and this process is repeated till the cloth is of a proper whiteness; after which it is soured and washed, as in the ordinary method. Oxymuriatic acid may be employed at proper intervals. Nine steeps, with exposure to steam, is found sufficient for linen, and five for cotton. By this method a considerable quantity of alkali is saved, as none of that which is employed is wasted.

In Bleaching Calicoes for the printer, a pure white is not so much the object to be attained, as that the colouring matter and the vegetable oil are fully extracted, or the cloth is what is called well rooted. This is effected by boiling and bucking the cloth, if linen, nine or ten times, and if cotton, five or six times, in a solution of alkali, rendered caustic by quick lime. The alkaline solution must be well settled, and transparent as water; because, if the lime remains either suspended or in solution in the water, it is apt to be deposited in the cloth, and destroy the purity of the parts intended to be white. To ascertain if the cloth be ready for printing, a strip is torn from the end, and printed with one of the mordants used to fix the dye. The cloth is then rinsed and immersed in cold water, which contains madder; the heat is gradually increased, and the cloth is alternately lifted up and down in the madder solution, till the colour is dyed of the required shade. If the cloth be properly bleached, the place stained with the mordant will alone have attracted the colouring matter of the madder, and the rest of the piece will remain white. If not properly bleached, the part intended for white will be stained a dirty light red, and it must again be boiled in the solution of alkali.

In bleaching either linen or cotton for printing, it is not customary to immerse them in any oxymuriatic solution, except in winter, when it is difficult to obtain a good white. When exposed also on the green, they are not artificially watered, but are merely exposed to the vicissitudes of the weather;

and hence this method is called dry bleaching.

We now come to the most peculiar part of this branch of bleaching; which is, restoring the white without injuring the colours after the printing is completed. When this is done, the white is generally very dull, owing partly to the imperfect manner in which the cloth has been bleached, partly to the mordant having been loosened by the increased temperature of the water, which uniting with the madder, or other colouring matter, is spread over the parts intended to be white. To remove this dulness without much exposure on the bleaching-green was long a desideratum; it is now effected by means of oxymuriate of magnesia. The usual methods of bleaching, and the application of oxymuriate, either of lime or of potash, either changed the colours or rendered them duller, or wholly discharged them. Oxymuriate of magnesia has neither of these effects; it clears the white without injuring or altering the colours. It has been found by experience, that of all the alkaline earths which are partially soluble in water, magnesia has the least effect in changing colours, which makes it well adapted, when mixed with the chlorine or oxymuriate, to the purpose of clearing the stains from the white of printed goods.

Our plate represents the apparatus now most generally employed to make the oxymuriate of magnesia. A is a furnace; B a cast iron vessel, to serve as a water-bath for the reception of C, a still made of lead, and adapted to the cast iron water-bath, in which it stands; *d d* are water lutes for the still to drop into, which keeps the whole tight and prevents the escape of gas; E is the head of the still, which dips into the gutter of water surrounding the still, and enables the workmen to take it off and put it on without difficulty; *f f f* are pipes and tubes; C C is a stirrer, made of a square piece of wood covered with lead; H a bent funnel for pouring in the acid; I an intermediate vessel to arrest any uncombined acid which arises during the process; K is a receiver made of lead, into which the alkaline solution is put, and which, when saturated, may be drawn off at N; L is the opening; and M M the stirrer, which, in large works, is moved by being connected with a steam-engine, or some other power. In preparing the magnesian solution, the earth must be broken in water like starch; it is then introduced into the receiver, K. Into the still, C, is put one part of good manganese, on which is poured two parts of muriatic acid diluted with its bulk of water; oxymuriatic acid is separated, passes into K, and dissolves the magnesia, which is kept suspended in the water by constant stirring. When it is required for use, as large a portion of it is drawn off into a copper containing water, and heated to the temperature of 170° of Fahrenheit, as will give the water a perceptible taste; and as soon as it is drawn off, the two must be mixed together by means of a clean broom. The printed goods are then run over the wince into the copper, till the white is sufficiently clear, which requires only a few minutes, and immediately afterwards the goods are streamed in pure water to prevent the further action of the bleaching fluid.

CHEMISTRY AS A SCIENCE.

Art. VI.

HYDROGEN.

HYDROGEN gas, the substance we are now to describe, for nothing is known of its base to which the term hydrogen strictly applies, is so named from a Greek word, signifying *water-former*. Hydrogen, in combination with oxygen, forming that fluid, and being always procured from it. By chemists it is considered as the distinguishing constituent element of water, which has now, for some time, been classed among compound substances.

The gas is thus procured:—put into the retort A, described in No. IV, Fig. 2, a quantity of iron filings.

Adapt a bent glass funnel to the opening at A, making it air tight, either by grinding, or by passing its end through a cork, which shall fit the opening. Plunge the beak of the retort under water in a pneumatic apparatus, and pour through the bent funnel about twice as much sulphuric acid by weight, previously diluted with four times its bulk of water, as there is iron filings in the retort. Immediately the diluted sulphuric acid reaches the iron filings, the mixture begins to boil or effervesce with violence, and bubbles of air escape rapidly from the mouth of the retort. After allowing as large a quantity to escape as you suppose will have supplied the place of the atmospheric air contained in the retort, place an inverted glass jar on the pneumatic shelf (see No. II) over the beak of the retort; and the gas which will soon fill it, displacing the water, is hydrogen gas.

It may also be procured in great abundance by causing the steam of water to pass through a red hot iron tube. This is done by placing an iron tube, part of a gun-barrel, for example, in a furnace, allowing the two ends to project, one on each side of the furnace, and placing it so that the narrowest end shall be somewhat lower than the other. Adjust a small glass retort to the upper end, and to the other a tube, the end of which must be introduced into the pneumatic trough. When the apparatus is thus ready, and the barrel is made red hot, bring the water in the retort to boil, and the steam passing through the red hot iron will be decomposed, and yield an abundance of hydrogen gas. For researches in which great accuracy is required, it must be received in jars over mercury, and exposed to the action of dry muriate of lime at a low temperature. By this means it is freed from water, which it otherwise holds in solution.

Being sometimes emitted in considerable quantities from the surface of the earth in mines, it very soon attracted the attention of chemical philosophers. Mayow, Boyle, and Hales procured it, made experiments on it, and observed some of its mechanical properties. About the beginning of the 18th century, its combustibility was known, and was often exhibited as a curiosity. But it was Mr. Cavendish who, in 1766, first pointed out the difference betwixt it and atmospheric air, and ascertained the greater number of its properties. He is therefore to be considered at least as having discovered most of its peculiarities. Since his time it has been investigated by a great number of chemists, and from their researches the following facts are fully established.

Hydrogen gas, like air, is invisible and elastic, capable of being compressed, and endowed with a property of dilating itself. It is the lightest body with which the researches of chemistry have yet made us acquainted. If the specific gravity of atmospheric air be assumed as 1.000, the specific gravity of hydrogen, at a temperature of 60 Fahr., and when the barometer is at 30 inches, is 0.0694. 100 cubic inches weigh 2.118 grains. It is therefore about 14 times less dense than common air, and 16 times less dense than oxygen gas. From the lightness of this substance, it is employed for the purpose of inflating balloons, which, when filled with it, rise rapidly through the denser atmospheric air.

For a very long time it was supposed to be totally incapable of supporting combustion; but the circumstance mentioned in our No. III, relative to platinum, makes this negative attribute of hydrogen gas doubtful. We do not say that the phenomena of the platinum becoming red hot when a stream of hydrogen gas is directed on it may not be otherwise explained, but till it is, it would be wrong to assert that hydrogen is in no case a supporter of combustion. In fact, this sort of phraseology is altogether derived from a theory which is already partly overthrown, and may, perhaps, be ultimately entirely demolished.—Combustion, in correct language,

only signifies that particular chemical change, decomposition of some bodies and the formation of others, which is accompanied by the emission of light and heat; and although the co-existence in the same spot of two certain substances is necessary to the production of this phenomena, it does not appear to be yet proved which of the two, or if both give out light and heat, and consequently it would be as correct to call the bodies, now named supporters of combustion, combustibles, and *vice versa*, as the contrary. If, as has been stated, sound logic would justify us in calling oxygen, chlorine, and iodine combustible bodies, it would equally justify us in calling hydrogen a supporter of combustion, for no body is more inflammable. In fact, its readiness to take fire procured for it, in the first instance, the name of inflammable air, and of phlogistion, or the principle of fire. If a lighted candle be brought to the mouth of a jar filled with hydrogen gas, the gas will take fire, and burn gradually till it is all consumed; but if the candle be plunged in the gas, it is extinguished. If the gas be pure, the flame is of a yellowish white colour, and if not pure, is tinged of different colours, according as it holds different matters in solution. A red hot iron will set fire to hydrogen, and it is estimated to take fire at about the temperature of 1000.

If a bottle containing the sulphuric acid and iron for the production of hydrogen be shut, with a cork having a long straight tube of a small diameter, the hydrogen issuing in a jet, and being set on fire, forms the philosophic candle of Dr. Priestley. If a long glass tube be held over the flame, its sides will be speedily covered with moisture, and harmonic tones will soon be heard. For a long time it was supposed that this was peculiar to hydrogen, and arose from the aqueous vapour; but Mr. Faraday has lately shown that carbonic oxide produces the same sonorous effect. It has been found, also, that the tones produced are different as the shape of the tube or glass vessel held over the flame is different.

If pure oxygen and hydrogen be mixed together, they remain unaltered; but if a lighted taper be brought into contact with them, or an eletric spark made to pass through them, they unite with great rapidity, and a violent explosion; and if they have been mixed in the proportion of one measure of oxygen and two of hydrogen, they are converted into water. This important experiment was first made by Scheele, but he failed to draw from it the proper conclusion. Mr. Cavendish ascertained that the water deposited was equal in weight to the gases which had disappeared, and hence he inferred that water was formed by their combination. This inference has since been confirmed by numerous experiments, and hydrogen received its name from being one constituent of water.

Hydrogen gas cannot be breathed without destroying life; and death is caused by depriving animals of oxygen, in the same manner as they would be destroyed if kept under water. Hydrogen gas is not sensibly absorbed by water, and therefore it may be collected over that fluid.

In consequence of its combining with a specific proportion of oxygen gas, hydrogen is employed as an eudiometer, or means of measuring the quantity of oxygen gas contained in any given bulk of an elastic fluid. A determinate quantity of hydrogen is mixed with a determinate quantity of the air to be tried, and the mixture is inflamed by an electric spark; the diminution of the volume beyond the quantity of hydrogen employed, indicates the quantity of oxygen contained in the gas. A number of ingenious instruments and contrivances are, however, employed for the same purpose, which will hereafter be described.

HABITS OF SALMON.

The discussion now going on in Parliament relative to the salmon fishery, has called forth a number

of papers on the subject; among which, one published by the Rev. Mr. Fleming, contains some curious remarks on the habits of this fish, which are worth quoting in a scientific journal. He confines his remarks to the fisheries of the *Tay*, which, he says, may be divided into the river-fisheries, and the fisheries of the Frith or sea-fisheries; and this distinction is of importance in adopting the most successful methods of capture. Salmon, though inhabitants of the sea, approach the shores, enter our large rivers, and mount upwards to their source for the purpose of depositing the spawn in their gravelly beds. As soon as this object is accomplished they retire again to the sea; and evidently to great depths, remote from cod and haddock ground, to recruit their exhausted strength, and prepare for future efforts of the same kind. Before beginning their journey, they are in a good condition, the body being loaded with fat, as a magazine for supplying the wants of the fish during migration, and for furnishing the great quantity of matter requisite for the evolution of the spawn. When the fish enter the Frith, at the commencement of their upward migration, and are thus in good condition, they are termed, in the language of fishermen, clean fish. At this period they are infested with the salmon louse, *caligus productus* of naturalists, and which chiefly adhere to the more insensible parts. When arrived at the place of spawning, the fish is lean, as the whole fat of the body has passed into the melt and roe. In this state they are termed red fish, and are worthless as an article of food. After the fish have spawned they are termed kelts or foul fish, and are equally despised with the red fish. The gills are now more or less covered with *entomoda salmonea.* The motion of the fish upwards from the sea to the river and place of spawning, is influenced by several causes. When there is abundance of fresh water in the Frith, the fish seem to proceed regularly and rapidly up the middle of the stream, enter the rivers, and hasten to their destination. Under these circumstances it is probable that the ripening of the spawn is accelerating by the influence of external circumstances. When the rivers are but scantily supplied with water, the fish which have entered the Frith, roam about in an irregular manner, influenced by the state of the tide, while those which have been surprised in the rivers by a draught, betake themselves to the deepest pools. In returning to the sea, after spawning, the fish seem to keep the middle of the stream in the river, and the deepest and saltest water in the Frith. Salmon enter the river and Frith at all seasons of the year, but they approach in greatest numbers during the summer months. Fish taken in May, June, and July, are much fatter than fish in the same condition as to spawning, taken in February, March, or April. They fall off in fulness very rapidly from August to January, when they are leanest. The principal spawning season is in November, December, and January. The roe becomes perfect, and the young fry samlets, or smelts, make their appearance in March or April. When the samlets leave the gravel where the spawn from which they issued had been deposited, they begin to move downwards to the sea. In their progress through the river, and until they reach that point where the Frith begins, or where the tide is always either ebbing or flowing; they crowd together and descend in the easy water at the margin. But upon entering the Frith, where the easy water is not at the edge, they betake themselves to the deepest part of the channel, and along with the kelts, disappear from observation.

VEGETATION AT DIFFERENT HEIGHTS.

All our readers know that all sorts of plants have different homes; some are natives of the sandy desert, some affect salt wave, and some spring up only

on the verge of eternal snows. This remarkable attachment to localities is particularly observable in mountainous countries, where we find grouped in a small extent, the productions of the icy north, and of the burning south; there the pomegranate, the orange, and the vine flourish in the sheltered valleys; a few yards above them, and the sides of the hills are ornamented with oak, beech, and birch; higher up, we meet with pines, and, finally, we come to the spot where lichens and moss mingle with the snow. So regular is the progress, and so precise are the heights at which plants will grow, taking the latitude of the place into consideration, that circles of vegetation have been constructed, showing at what heights the different plants may be found cultivated throughout the globe. In connexion with these general results, tables of the heights where different vegetables are actually found, have an additional interest; and we therefore conceive the following table of the various heights at which different trees and shrubs grow in the Vallais and Savoy, worthy of being transferred to our pages. The extreme height implies situations open to the south and west, and sheltered from the north-east wind, the height varying very much, according to the aspect in an alpine country. The heights are English feet above the level of the sea, and the latitude 45° 36′ to 46° 30′.

Vines	2380
Maise	2772
Oak	3518
Walnut-tree	3620
Yew-tree	3740
Barley	4180
Cherry-tree	4270
Potatoes	4450
Nut-tree	4500
Beech-tree	4800
Mountain Maple	5100
Silver Birch	5500
Larch	6000
Fir le Sapin	6300
Pinus Cembra	6600
Rhododendron	7400

The line of trees reaches the height of 6700 feet, the line of shrubs 8500. Some plants on a granitic soil grow at 10,600, above which are a few lichens, but vegetation ceases at 11,000 feet. In the garden of the inn kept in summer at the Schwarrenbach, on the passage of the Gemmi, carrots, spinach, and onions are cultivated at the height of 6900 feet. In the southern part of Savoy, the height at which pines will grow is about 2600, but near this elevation the crops failed in the cold summer of 1821.

TO CORRESPONDENTS.

The communication promised by a Chemist, we shall, we believe, be able to procure.

We thank A Constant Reader for his letter, and his communication shall be inserted.

C. A. D. we take to be a Lady, and shall be extremely happy to insert the paper she promises us. We beg leave here to remind all our Correspondents, that communications from the other sex, on any subject, but particularly on botany, will be very acceptable.

Crucible has been received; we shall probably put him on in our next.

Though we frequently read the work to which ANTI-STAHL *alludes, we did not see the Article he mentions; and, if it were not now too late, we must beg to be excused noticing it, as we do not wish to take on ourselves the task of criticising every Periodical.*

⁎ Communications (post paid) to be addressed to the Editor, at the Publishers'.

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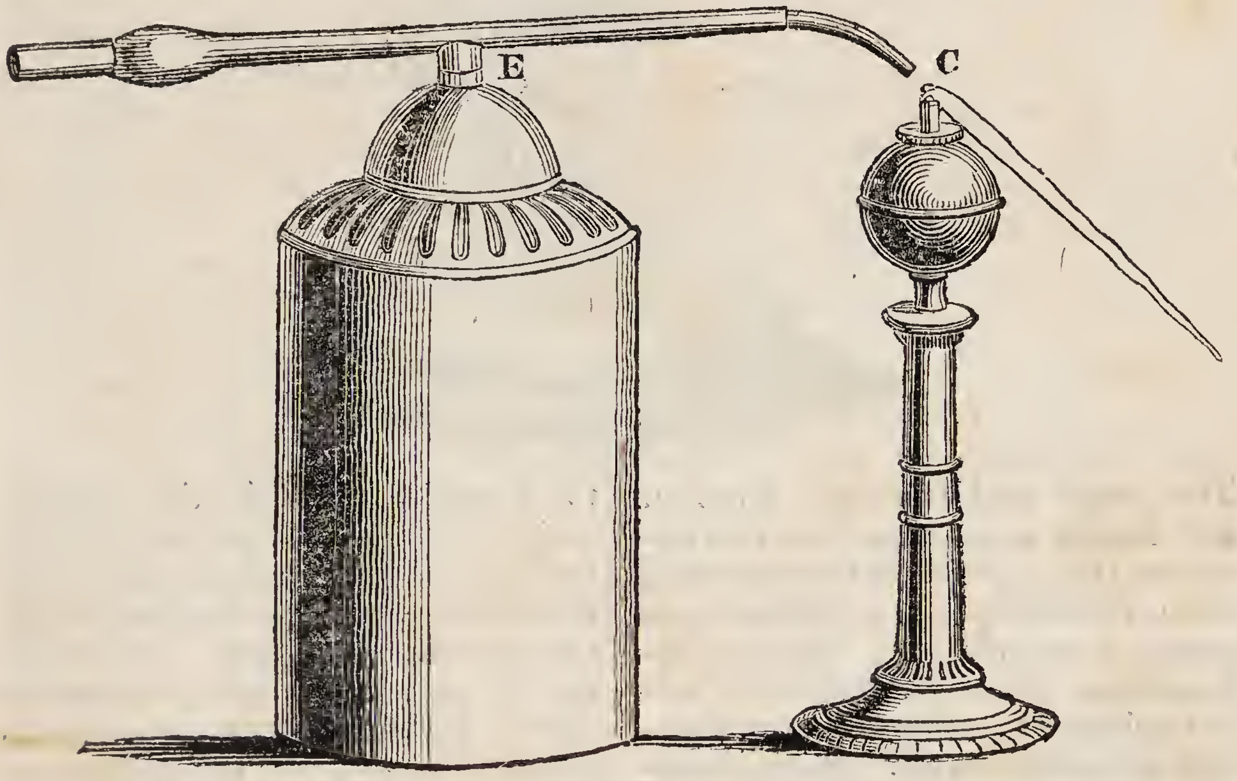
The Chemist.

"—— Search, undismayed, the dark profound
Where nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. VII.] SATURDAY, APRIL 24, 1824. [Price 3*d*



CONTENTS.

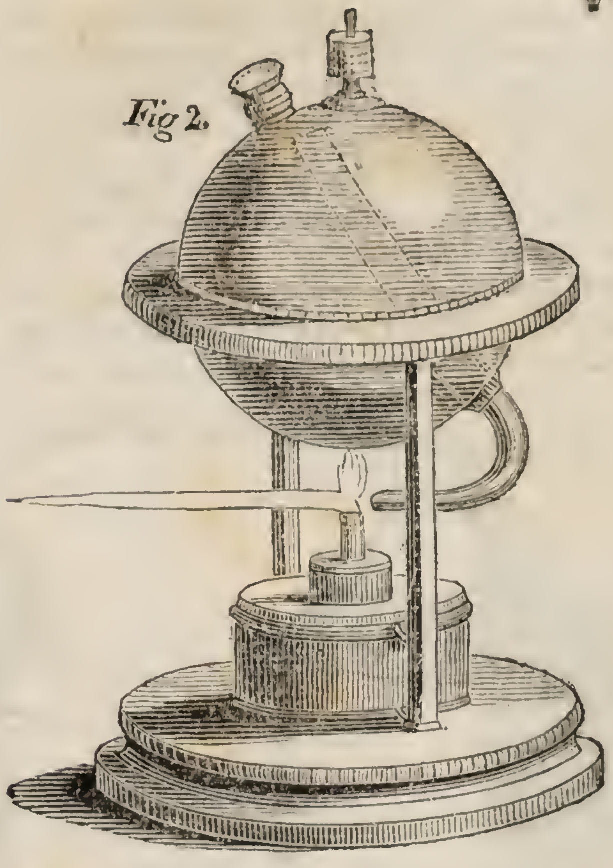
CHEMICAL APPARATUS.

Description of the Plates.

The present Plate represents three different blow-pipes, an instrument which is very powerful in the hands of a skilful operator, and without which many of the most brilliant discoveries of modern times would have been unknown. Every effect of the most violent furnaces may be produced by the flame of a candle or lamp, urged on a small portion of any substance by the blowpipe. This instrument is sold by the ironmongers, and consists merely of a brass pipe, about one eighth of an inch diameter at one end, and the other tapering to a much less size, with a very small perforation for the wind to escape.

Fig. 1

Fig 2.



The small end is bent. In fact it is hardly necessary for us to describe this instrument in its usual form, for it must be well known to most of our readers, being in general use among braziers and silversmiths, to fuse and unite separate pieces of metal. For philosophical purposes the blow-pipe is provided with a bowl or enlargement, in which the vapours of the breath are condensed and detained. This sort of blow-pipe is represented by Fig. 1. It is also useful to have three or four nozzles of a larger or smaller bore, which can be fixed on the small extremity, so that a greater or less quantity of air may be directed on a larger or smaller flame. The effect to be produced by this pipe is to send a stream of air for several minutes, without interruption if necessary, on the substance to be examined. To accomplish this, some art is requisite, which it is easier to acquire than describe. It is done by applying the tongue to the roof of the mouth, so as to interrupt the communication between the mouth and the passage of the nostrils, by which means the operator is able to breathe through the nostrils while he forces, by the muscles of the lips, a continual stream of air from the anterior part of the mouth through the blow-pipe. When the mouth begins to empty, it is replenished by the lungs in an instant, while the tongue is withdrawn from the roof of the mouth and again replaced. By this means a practised operator is enabled to continue the stream for a long time without feeling any fatigue. A wax candle of the common size, but thicker wick than usual, is very convenient for making experiments, but a tallow candle will do. The wick, kept rather closely snuffed, should be turned down, so that a part of it should lie horizontally. The stream of air must be blown along this horizontal part as near as may be, without striking the wick. If the flame be ragged and irregular, it is a proof that the hole is not round and smooth, and if the flame have a cavity through it, the aperture of the pipe is too large. When the hole is of a proper figure, and duly proportioned, the flame consists of a neat, luminous blue cone, surrounded by an-

other flame, of a more faint and indistinct appearance. The strongest heat is at the point of the inner flame.

The body intended to be acted on by the flame and blow-pipe ought not to exceed the size of a pepper-corn. It should either be laid on a piece of well-burned, close-grained charcoal; or, if likely to be affected by this substance, may be placed in a small spoon, made of platina or gold. The size of the plow-pipe permitting it to be carried in the pocket, is a strong recommendation of it, as an instrument of chemical analysis. It does not, indeed, enable us to determine the quantities of the constituent elements of bodies; but it enables us to detect those elements, and teaches us in what manner we may best proceed in ascertaining quantities. By it experiments may be made on the minutest specimens, and on the most valuable materials; and when to these advantages is added the fact of the whole process being from the beginning to the end under the eye of the operator, it deserves to be styled one of the Chemist's most valuable instruments. Of late years numerous attempts have been made to improve it: two of which we shall now proceed to describe, and in another Number we shall give an account of the blow-pipe which Mr. Gurney employs.

Fig. 2 in our Plate, represents Mr. Hook's blow-pipe. The action of flame, it is well known, is much increased by supplying it with oxygen gas instead of common air. Other gases or vapours have a similar effect; and Mr. Hook's blow-pipe is intended to make the vapour of alcohol answer this purpose. It consists of a hollow sphere, supported on a ring fixed on two pillars. The bottom of the sphere may be made flat, by which the action of the flame, from a small lamp placed below it, will be increased. The lamp slides up and down on the pillars, and by means of two small springs may be fixed at any height. The lamp heats the boiler, and its flame is urged by the vapour which issues from the nozzle below. This nozzle is the termination of a tube inside the sphere, the upper end of which being open, but above the surface of the spirit, permits the vapour constantly generated by its boiling to descend with a steady stream through the nozzle, while it never allows the alcohol itself to escape. At the top is a safety valve, loaded with a weight, or so constructed as to admit of any degree of pressure the experimenter pleases. At the top, also, but a little on one side, is a hole with a screw plug, for pouring in the alcohol. The wick of the lamp is not in the centre, but moves round it in a small circle, and by this contrivance its distance from the jet of the alcohol vapour can be made greater or less, at pleasure. The advantages of this instrument over the common blow-pipe are, that the supply of air or vapour is constant and steady, and the effect is greatly increased by substituting the inflammable vapour for common air.

The figure in the front represents a blow-pipe constructed on the same plan as the blowing engines for iron furnaces. It consists of a vessel of japanned tin or glass, containing water; and also containing another vessel, closed by a dome at top and open at bottom. The inner vessel is supported in the outer one by a ring or cover, soldered to both, and perforated with several holes, as represented in the Plate. On the top of the dome is a short brass tube, for the reception of a socket issuing from a common blow-pipe. The lamp placed before the end of the blow-pipe can be raised or lowered at pleasure. This blow-pipe is used by blowing in it; the air passes from the pipe into the inner vessel, which expels the water at the lower end, and the pressure of this fluid, after a short time, acts constantly in expelling the air at the other end of the pipe. The great advantage of this machine over the common blow-pipe is, that it enables the operator to cease for a moment without the emission of the air

being stopped. It is quite easy to connect a bladder filled with oxygen gas to the pipe; but it is so far surpassed by other contrivances of the same kind, that we do not think a further description requisite.

BREAD.

ALTHOUGH making bread, being a domestic art practised on an extensive scale, appears now so familiar that we wonder how men were ever ignorant of it, yet it is a fact that the art was not an early discovery, and there are many nations even at this day to whom it is altogether unknown. Simple as it appears, making bread is an art of which the principles were only of late discovered, and indeed are not known to most of those who practice it. The process of fermentation which goes on in the flour, the perfect change which ensues in its nature, the temperature necessary for the operation, are all chemical processes, and are to be explained by chemical laws. Supposing an explanation of the operation may be both amusing and advantageous to our readers, we mean to give a short sketch both of the history of bread making and the principles on which it is conducted. It is not our intention to instruct the experienced baker; the art must be learned over the kneading-trough, and at the mouth of the oven, but merely to throw over the operation some of the light of science, enabling those who perform it, which is all we aim at, to reason about the processes they carry on, and perhaps to improve them.

According to the prevailing tradition of almost every country, acorns and berries appear to have constituted the chief vegetable food of the earliest races of men. It is indeed obvious that the ripe fruits which nature tenders to the hand of man, ready for his sustenance, and tempting his acceptance by their variegated appearance, must have demanded his attention before those lowly grains which spring mingled with the common grass, which require considerable labour before they can be collected in sufficient quantity for food, and which must then be prepared to adapt them to nourish him. So great was the benefit derived from the employment of grain as food, and so extraordinary was the invention thought to be, that the Grecian fabulists attributed them to a goddess who descended from heaven for the purpose. Whether Ceres, to whom this beneficent work is ascribed, really came from heaven, or whether men, following the impulse of their gratitude, worshipped as a divinity the mortal who had conferred this benefit on them, is a question of little importance, and which cannot now be decided; but in either case, the worship of this deity shows how high the benefit was estimated, and what a vast improvement it must have effected in the condition of men. Pliny, a Roman author who flourished about the time of Jesus Christ, informs us that the inventions of Ceres did not extend to making corn into bread, her beneficence being limited to her means, and she, as well as the ignorant mortals who worshipped her, knowing nothing of this process. At first, barley, which is fit only for making cakes, was the species of corn used for food; and even after the method of reducing it to flour had been discovered, it was long before men acquired the art of making bread. At first they contented themselves with boiling their flour or meal into a kind of porridge or pudding, and even to the present time this mode of using flour is the only one which is known in many parts of Africa, and almost the only one which is practised by the peasantry in many parts of Italy. The *couscous* of the negroes on the coast of Africa is a grain, which the women grind by rolling a round stone in a piece of wood hollowed out, and then boiling it. This is the principal food of the people. In the same manner the *polenta* of the Italians, which forms a large part of the food of the peasantry, is maize, or Indian corn, boiled into a sort of porridge, and in some

remote places in Italy it is impossible to procure any other substitute for bread. The next step in the process of bread making seems to have been the baking what was before boiled. The flour was kneaded with water into dough, and the bread was only an unleavened cake. Then there was no other division of labour than what could take place in single families. Baking cakes was not the occupation of a particular set of men. Princes, if there were any—and certainly there were men who obtained power by their influence, or assumed it by their strength—were their own butchers, while their lady queens were the family bakers. Monarchs hunted their own food, and brought it home ready slaughtered, while the fair persons who shared their tents or their caves and their power, gathered the grain and prepared the meals. Ovens were a late invention, and the cakes were at first roasted on the embers or placed on a heated stone.

Making the bread undergo the process of fermentation, which was the natural consequence of moistening it with water, and the adaptation of this to making a more palatable and wholesome food, was probably the next step in the process. At what period of the world, and where this was discovered, history, which has delighted chiefly in recording brutalizing schemes of plunder, war, and conquest, leaving the tale of human inventions untold, and casting to the winds the records of human improvement, does not inform us. We know from sacred writ, that the practice of making leavened, or fermented bread, is of very remote antiquity. It was the most general way of preparing grain among the Jews; and unleavened bread was only used in sacrifices, or on solemn festivals, or when some circumstances rendered it impossible to have bread prepared in the usual way. The same people, at an early period, understood the construction of ovens, the use of which was imported from the East into Europe. Among the Asiatic Greeks, the Lydians, and Phœnicians, ovens were also in use at an early period, and baking was a distinct profession. Five hundred and eighty years after the foundation of Rome, the armies of that republic brought bakers with them to Italy, on their return from Macedonia. These men were both millers and bakers, carrying with them ovens and hand-mills, and were named *pistores*, from the old practice of bruising corn in a mortar. The Greeks seem to have been for a considerable period the only bakers at Rome; and in the time of Augustus there were 329 public bakehouses in that city, all of which were occupied by Greeks. These men were there held in high estimation; and though cooks and bakers are, in modern times, not much respected classes of men, in a political point of view, it would seem to be good policy to have a high respect for those in whose hands we daily trust our lives and our health. We will not say, however, that such was the motive for the regulations of the Romans. It does not appear that the Greeks they brought with them from Macedonia were slaves, and as most or all of the handicrafts at Rome were practised by slaves, it was necessary to confer on the free bakers some privileges to distinguish them from other artisans, who were the property of masters. They were incorporated into a company having a number of freedmen associated with them; and all their children, even the husbands of their daughters, were obliged to join the corporation, or remain members of it. To preserve them upright and honourable, they were forbidden to associate with gladiators, the pugilists and prize-fighters of those days, with whom, as in our times, the nobles of the land, being above censure, did associate, and whose language and manners they imitated. But the bakers, for fear of contamination, were not to mingle with the prize-fighters, and they were exempted from several duties which other

citizens were obliged to perform. Some of the bakers even found their way into the senate. The property of this corporation was held in common, and no part of it could be alienated. All the mills, utensils, slaves and animals necessary for their business were given to them, and they received considerable portions of land. Criminals and slaves, who had committed trifling offences, were set to work in the bake-houses. In Rome, it is evident from this, baking was carried on with considerable skill. From thence it passed into France and into Britain. At what period it became common here we are not informed; but in the 16th century, the only bread known both in Sweden and Norway was unleavened cakes, kneaded by the women. For a long time, in our own country, it is supposed the art of baking bread was practised only by the females of a family, and baking was not a distinct trade. Even in many country places now there are no bakers; and in most of the towns in the north of Europe, the bread, whether the unleavened cakes of the Norwegians and Swedes, for they are still the general bread of those people, or whether the large rye loaves of the Germans, are made by the women in each house, and not by regular bakers. At what period baking became a distinct trade in the several parts of Europe, we have not been able to learn, but at present it is so, and the mode of making bread is nearly the same in all.

(To be continued.)

OXALIC ACID AND EPSOM SALTS.

Very recently the newspapers contained an account of another of those fatal accidents which some time ago were so frequent, from taking oxalic acid in place of Epsom salts. The best way to distinguish them is by the taste, Epsom salts being bitter, and oxalic acid very sour. But most persons, particularly young people, have such an aversion to medicine, that they do what they can to swallow it without tasting it; and hence this test at the moment of taking the draught is of no use. Oxalic acid must be taken in doses of two or three drachms to make it effectual as a poison; and a single crystal applied to the tongue will be followed by no pernicious effects. Hence, before taking salts this test should be employed. Epsom salts tried in this manner will occasion scarcely any taste, but a single crystal of oxalic acid leaves a sensibly acid and acrid taste in the mouth. Besides this, the crystals of the latter are longer and more like a needle than those of the former; and any person who has once seen the two together is never likely afterwards to mistake them. Chemical tests are not always, indeed they are very seldom at hand; and therefore it is far better, and more certain, to attend to the appearance and taste of the medicine. We would, on this account, caution all parents who are about to administer salts to their children, and all persons about to take them, to examine their appearance and try their taste. If a sensibly acid taste is perceptible, the medicine should be rejected; if the crystals are all like needles, the substance is not Epsom salts, but oxalic acid. Should the latter substance be swallowed by accident, powerful emetics ought to be immediately administered, and their effects should be aided by copious draughts of warm water, containing chalk or magnesia.

PROOF THAT THE ATOMS OF THE GASES ARE OF DIFFERENT SIZES.

M. Dobereiner having filled a large glass flask with hydrogen, and left it standing over water, it was observed some days after, that the water had risen in it above one-third of its capacity. The only cause for this effect that could be assigned was, the existence of a very minute fissure in the glass. Filled a second time, and left over

water, the fluid had risen in it above an inch and a half in twelve hours, and in twenty-four had risen two inches and three quarters; during which time the barometer and thermometer had not sensibly altered. In other experiments, vessels of other forms were used, and the water uniformly rose in those having fissures.

When one of these vessels filled with hydrogen was covered by a bell glass, or when the vessels were filled with atmospheric air, oxygen, or azote, instead of hydrogen, no change took place.

M. Dobereiner considers the effect as due probably to capillary action. He suggests that all gases may be considered as consisting of solid atoms of various sizes, enveloped by atmospheres of heat also very different, and that hydrogen, though it has the largest atmosphere of heat, has the smallest atom, and is thus permitted to escape by fissures, which retain the other gases. "Probably," he says, "fissures may be formed which will permit azote to pass, but not oxygen, and others again which will let the oxygen out, but not carbonic acid gas.

Another experiment which seems related to this subject, is as follows:—A thermometer tube had been drawn out very fine in the lamp, and it being desired to have it filled with alcohol, the point was immersed in that fluid, and the bulb heated until no more bubbles of air escaped; the tube was then cooled, but no alcohol entered. When again heated, abundance of bubbles of air passed out through the alcohol, though when re-cooled no alcohol would enter. Upon examining the tube with a lens, nothing was seen which could prevent the entrance of the alcohol; on withdrawing the tube from the alcohol, the external air entered with a hissing noise. M. Dobereiner conceives that the diameter of the tube was so small that the alcohol could not enter, but only the air which it contained.—*Ann. de Chim.* xxiv. 332.

MR. PHILLIPS'S LECTURES ON CHEMISTRY,

At the London Mechanics' Institution.

On Wednesday Mr. Phillips began a course of Lectures on Chemistry, at this Institution. We were very happy to see that his audience was numerous, and listened to his instructions with attention and pleasure. The necessity we are under of going early to press, prevents us at present taking any further notice of the lecture, except saying that it was distinctly delivered, and illustrated by several well performed experiments. In our next Number we shall give a more detailed account of it.

COMBUSTION PROMOTED BY THE POKER.

To the Editor of the Chemist.

Sir,—In answer to the question by a few admirers of "your little Publication," as to the effect of a poker being placed across the fire, allow me to suggest that it may have arisen from the old custom of placing the shovel perpendicularly in front of the grate, the efficacy of which in promoting a more rapid combustion, may, I think, be philosophically explained as follows:—The grate being always situated at the lower part of the room, the constant influx of air from the different apertures, such as the doors and windows, must naturally have a descending motion, replacing that portion which, becoming rarified by heat, escapes by the chimney; place, then, any obstruction opposite to the expiring embers, and they are sheltered from the cold descending current, and exposed only to that which must necessarily ascend through the bottom of the grate. I humbly submit this explanation to the judgment of your admiring friends.

Your obedient servant,

Caloricus.

INVISIBLE-VISIBLE INKS.

Sympathetic or secret inks are fluids, which may be written with on paper, and are invisible when

dry or cold, but acquire colour by heating the paper, or by the application of some chemical agent. These phenomena arrested particularly the attention of the old chemists, and accordingly, in their fanciful ways, they called them sympathetic inks. Thus, if letters be traced on paper with *muriate of cobalt*, the writing is invisible; and by holding it before the fire, the characters speedily assume a green colour, which again disappears as the paper cools. The writing made with this ink may, therefore, at pleasure be made visible or invisible, by alternately warming and cooling the paper, if care be taken not to expose it to a greater degree of heat than is necessary to make the invisible writing legible.

This experiment is rendered more amusing, by drawing the trunk and branches of a tree in the usual manner, and tracing the leaves with sympathetic ink. The tree appears leafless till the paper is heated, when it suddenly becomes covered with a beautiful foliage.

Various theories have been proposed to account for this remarkable change. According to some, it is owing to the moisture of the atmosphere being absorbed that the colour disappears, and when this is driven off by heat, that is restored. But to this opinion it has been objected, that the same effect is produced, when paper, on which characters have been written with this ink, is entirely excluded from the atmosphere, by being introduced into close vessels. According to others, the sympathetic effect of this ink depends on the iron which is combined with the cobalt. Some suppose that the concentration of the solution, which takes place by the action of heat, is the cause of the appearance of the colour; and its dilution, by absorbing moisture from the atmosphere, the cause of its disappearance; while, again, others are of opinion, that it is partially deprived of its oxygen by being heated, and absorbs it again in the cold, when the colour vanishes. The former explanation appears to be confirmed by the fact, that the characters are rendered visible by confining the paper in a vessel with quick lime or sulphuric acid, either of which attracts humidity powerfully. The green colour cannot, however, be ascribed entirely to the concentration, but is owing to the temperature; for the solution itself becomes green when moderately heated in a close phial, and loses this green colour as it cools; nor is it easy to explain how the temperature produces this change of colour. Mr. Hatchett has suggested, that it may operate by causing a "temporary difference to take place in the proportion of oxygen existing in the acid menstruum and the oxide;" and it is not impossible, that a high temperature may enable the metal to attract a small portion of oxygen from the acid, which acid may again separate from the oxide when the temperature falls.

The sympathetic ink is prepared in the following manner:—Put into a matrass one part of cobalt or jaffre, and four of nitro-muriatic acid; digest the mixture, with a gentle heat, until the acid dissolves no more cobalt; then add muriate of soda, equal in quantity to the cobalt employed, and four times as much water as acid, and filter the liquor through paper.

MEANINGS OF THE WORD "CHEMISTRY."

The word "Chemistry" has had no less than five different meanings at different times. First it signified what is now called *natural philosophy;* afterwards it meant the art of *working metals;* and subsequently was restricted to the art of *making gold;* afterwards it was extended to *include also the discovery of a universal medicine;* and finally it settled in its present meaning, "the science which investigates the changes which take place in bodies unaccompanied by sensible motion.

Fig. 2.

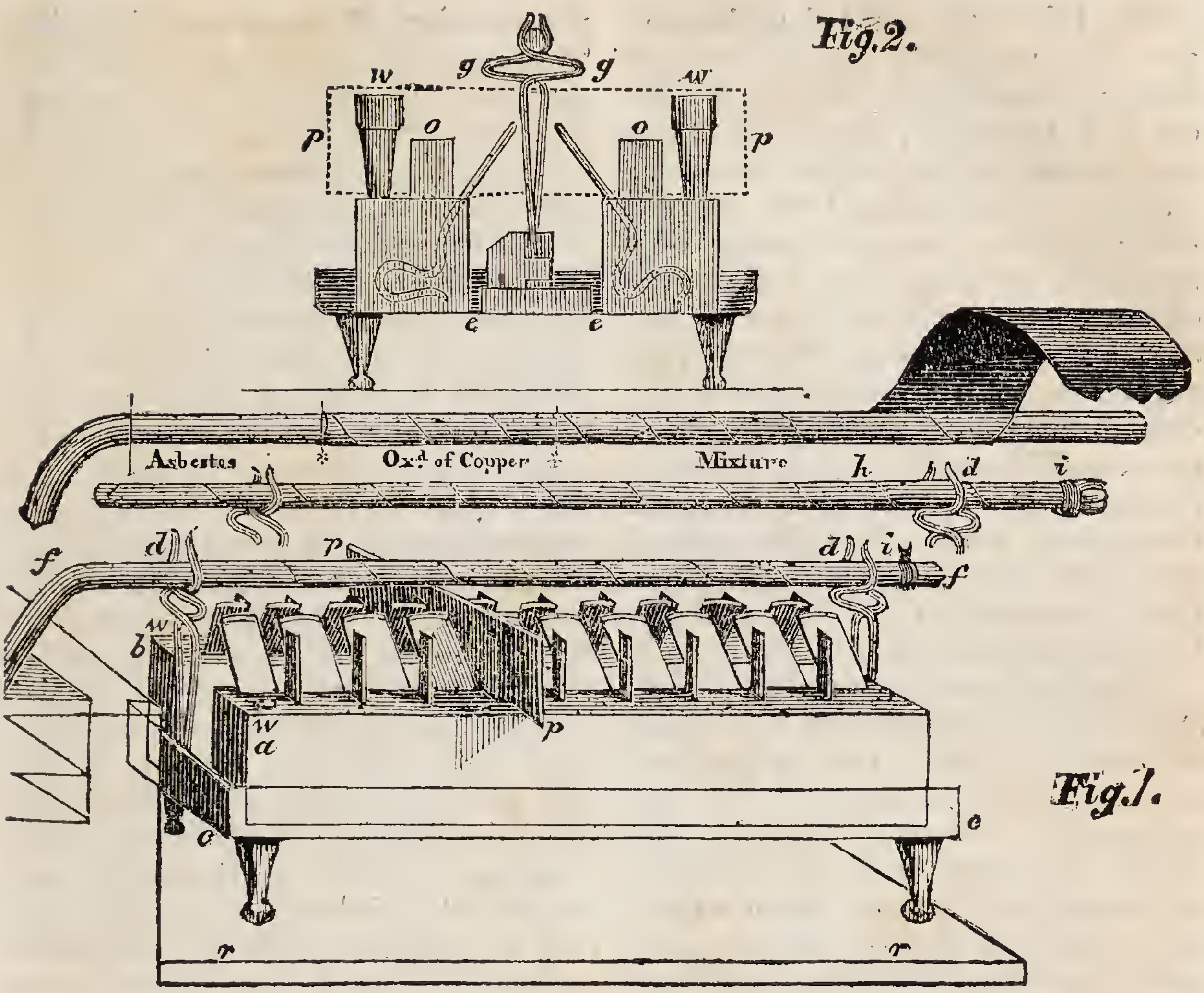


Fig. 1.

MR. COOPER'S APPARATUS FOR THE ANALYSIS OF ORGANIC PRODUCTS.

(*Abridged from the Transactions of the Society for the Encouragement of Arts.* Vol. xli.)

THE very great interest which is now felt in the various parts of Europe, in the analysis of animal products, and the curious results which have been obtained, particularly in France, by prosecuting this analysis, makes every contrivance for performing it with accuracy of considerable value. Of late years, numerous methods have been suggested by scientific Chemists for this purpose, all of which, even when they possess great merit, are liable to some objection. Mr. Cooper has, therefore, suggested another contrivance, an account of which we shall now present to our readers:—

Fig. 1, *a a* and *b b*, two long spirit lamps, each having ten burners and wicks, the burners of each lamp sloping towards those of the other, as seen in the end view, Fig. 2; they are placed in a tin tray, *c c*, mounted on four feet; this tray is perforated in the middle the whole length of the lamps, and as wide as *e e*, Fig. 2. The object in making the burners sloping is, that they may clear the lamps and approach each other as near as requisite, and yet leave a clear current of air to the flames, and the tray is perforated and mounted on feet to admit this current.

d d are springing wires, placed at each end of the tray to receive the tube *f f*, which contains the substances to be analysed, and to hold it over or between the two rows of flames; by pressing the finger and thumb on the two shoulders, *g g*, Fig. 2, the wires open to receive the tube, and close on letting go; and should the tube be shorter than the lamps, an additional support is placed through the opening, *e c*, of the tray to rise between the flames, and hold the end of the tube; the tubes are hermetically sealed at one end, and the materials put in while the tube is straight; it is then bent at the other end to suit the mercurial trough.

The tubes are coated with copper foil, wrapped spirally round them; if each succeeding fold lie on half the other, there will be a double coat of copper all the way; if it lie on two-thirds, there will be three layers of copper, and so on; by which the glass tube is supported from bending when hot, and becomes very uniformly heated. The spirals are continued beyond the end of the tube, to reach the support, and leave the end within the flames. The dotted lines at *h*, of the second tube, show the end of the tube, short of the support; the foil is secured at the last coil by binding wire, as at *i*.

The third, or uppermost tube, shows the foil in act of being wrapped on, also the proportion of the space occupied by the materials; first, the mixture of oxide of copper with the material to be analysed; next, pure oxide of copper, or copper filings; and lastly, asbestos. When the quantity of water formed is considerable, the tube is either blown into a bulb, or melted on to one ready prepared.

As the wicks nearest the trough are to be lit first, and the remainder in succession, as the former finish their action, there are upright supports of tin, *o o*, fixed on the lamps, one for each space between the burners, against which to rest a slip of tin, *p p*, to prevent the lighted wicks from kindling those next, and it also enables the experimenter to blow out those that have done their duty. In Fig. 2, the tin slip, *pp*, is shown by dotted lines, reaching from lamp to lamp; little flat caps are put on each burner when done with, to prevent the waste of spirit.

It will be known to our readers, that oxide of copper is now extensively employed in the analysis of animal products; it is the instrument also which Mr. Cooper recommends. The oxide of copper (he says) used in the experiments is best procured from the residuum of verdigris, (binacetate of copper) which is or was used to be distilled in glass retorts for the preparation of strong ascetic acid. The reason I prefer the oxide of copper prepared by this process over any other is, that it is more likely to be free from impurity than that which is prepared by precipitation from acid solutions. Should it, however, happen that at any time such an oxide is not readily to be procured, the oxide that is obtained by heating copper plate and quenching it in water may be substituted, although I give the decided preference to the former, on account of its mechanical texture being much more porous, and consequently exposing a larger surface to the action of substances in vapour passing through it; neither is it so likely to choke up the tube and endanger its bursting, and of course causing a failure in the experiment. Supposing the residuum above mentioned to be employed, it is requisite to expose it to a red heat for twenty minutes or half an hour, to destroy the carbonaceous matter that invariably accompanies it; it should then be pulverized and sifted through a fine wire sieve; that portion which has passed the sieve being again sifted through a finecy press or lawn sieve, the finer dust is got rid of, and each of these portions may be separately kept, and is applicable to different purposes.

A tube of hard glass, either of crown or green bottle glass, being selected about 14 or 15 inches long, and from one to two-tenths of an inch internal diameter, clean the inside from dust by passing through it a piece of cotton, then make it as hot, from end to end, as the fingers can conveniently bear, and draw air through it into the mouth (but not blow through it) while it is still hot, to ensure its perfect freedom from adhering moisture on its inside, and while still warm seal up one end with the blow-pipe; the tube may be now balanced, but it is necessary in this, as in all other operations of analysis where very small quantities are concerned, that the beam should be affected by 1-200 or 1-300 of a grain, even when loaded with 400 or 500

grains at each end.* The substance intended for analysis is now to be introduced into the tube; if it be solid, as for instance camphor or a like substance, it may be broken into small fragments and shaken down to the bottom; if it be a fluid, as a volatile or fixed oil, it may be introduced by means of a small funnel, which is prepared, on the instant, from a piece of flint glass tube of convenient size and substance by heating it near one of its extremities, and suddenly drawing it out. It is evident the semifluid glass will be thus elongated, and a funnel, with nearly a capillary tube, and of any required length, may be obtained. A very little practice will render this part of the business very easy to be accomplished; the funnel is to be put into the tube, reaching very near its bottom or sealed end, and the fluid matter introduced without soiling the upper part of it; care must also be taken, on withdrawing the funnel, that no portion of the fluid is attached to its lower extremity, or otherwise this will happen. The volatile substance, or that which is capable of being rendered so by a red heat, being now introduced into the tube, its weight is to be very carefully taken, which, when done, the oxide of copper, freed from its fine dust by the lawn or cypress sieve,† and recently heated red hot, is to be poured into the tube, to the length of eight or ten inches, having previously put into the tube as much only of perfectly cold oxide as will absorb the fluid portion of matter, and stand about the same height above the solid substance. Having proceeded thus far, a quantity of recently ignited asbestos, or spun glass, (the former is the best) is put lightly into the tube, so as to occupy an inch or two, depending on the quantity of water that is expected to be formed. The tube is now to be bent, as represented in Fig. 1, and its weight may be again taken; it is then to be covered with thin sheet copper, and placed between the forceps, as represented in the same figure, with its open extremity inserted under a jar in the ordinary mercurial pneumatic trough, or it may be connected with a gasometer of Mr. Pepys's construction, which, when ten or twenty grains of a substance are employed, and the quantity of either carbon or azote it contains is considerable, is convenient. Small mercurial graduated jars may be used, even if very large quantities of gas are obtained, as the process of decomposition may at any time be stopped almost instantaneously,* and the quantity contained in them being registered, they may be alternately filled with mercury and displaced by the gaseous products, as long as any comes over, reserving only the last portions for examination, of which a few cubic inches alone are requisite.

The lamps being trimmed with very short wicks, are now to be lighted, lighting those first that are nearest the gasometer, and when the tube is red hot, the remaining ones may be set fire to in succession, until the whole length of tube that is filled with the oxide is red hot. One set of lamps for a tube, of the size I have mentioned above, is generally sufficient; but should tubes be used of larger size, such as half an inch in diameter, both sets will then be required. In coating the tube with sheet copper, care must be taken not to cover that part of it which contains the asbestos, otherwise the heat will be conducted by it to that portion of tube, and prevent the condensation of the vapour of water, which is very essential. In the analysis

* The balance I have been in the habit of using was made for me by Mr. Robinson, and is sensibly affected by 1-400th of a grain, when loaded with 1000 grains at each end.

† The finer portion is taken from the oxide to allow more freedom of passage for the vapour through it; in some cases the rush of gas is so sudden, was it not for this precaution, it would be likely to burst the tube.

* I consider this as one of the advantages of this apparatus.

of substances containing much hydrogen, and especially when ten or twelve grains of them are taken, it will be found convenient to attach to the tube a small bulb, to contain the water that is generated.

If the substance be a vegetable salt, it must be freed from all extraneous moisture; this is best effected by suffering it to remain over an hygrometric substance in vacuo for some time.

Those who have not the convenience of an air-pump, may operate in this way: A wide-mouthed phial, provided with an accurately ground stopper, being procured, select another and much smaller phial, that will easily go into it; strew on the bottom of the larger phial a quantity of chloride of calcium, (dry muriate of lime) put into the smaller phial the substance in fine powder intended to be dried, and place this in the larger phial standing on the chloride; moisten a small piece of bibulous paper with alcohol, and put it into the larger phial, but not inside of the smaller one; when thus arranged, set fire to the moistened paper, and when it has burned a second or two put the stopper in its place, and take care that it is perfectly tight; a very good vacuum is by this means formed, and the process of dessication goes on rapidly.

The substance in this state is to be mixed with a portion of the oxide recently ignited, but in this case suffered to cool, then as quickly as possible introduced into the tube. As much of the oxide may be used as would occupy an extent of tube equal in proportion to that shown in the upper tube; a quantity of oxide is then to be put upon the mixture, and over this it is sometimes well to put a small quantity of copper filings or scrapings; upon these the asbestos is to be used as above, and the operation of ignition is to be conducted in a somewhat different manner to that last mentioned.

The lamps in this case are to be lighted at the extremity next the gasometer, and as soon as the gas ceases to be liberated, the next in succession may be employed, and so on to the end; but instead of suffering the whole of them to continue in flame, it is as well to extinguish a portion, and to suffer only about three or four to remain in operation at once, but taking care to ignite the whole extent of tube at the close of the process. The gaseous products being collected, and their bulk noticed, their analysis is to be conducted in the usual manner, taking care, however, in all instances, to observe the precise temperature of the gases, that their bulk, as also the quantity of aqueous vapour they contain, may be estimated, and either to equalize the internal and external surfaces of the mercury, or to calculate the volume of gas by the difference of mercurial levels.

CHEMISTRY AS A SCIENCE.

Art. VII.

NITROGEN.

If a quantity of iron filings and sulphur, mixed together and moistened with water, be put into a glass vessel, and all communication with the external air be cut off, in the course of a few days a portion of the air will disappear, and the remainder, which, by this process, is incapable of further diminution, is called nitrogen or azotic gas. To render it pure it is agitated with water. If phosphorus be substituted for the iron filings and sulphur, and the temperature remain about 60°, the absorption will be completed in less than twenty-four hours. Or introduce into a wide mouthed glass vessel, placed in the pneumatic trough over water, 100 measures of common air, and about 80 measures of what is called nitrous gas, the mixture will acquire a brownish red colour, a large portion of it will be absorbed by water, and there will remain 79 measures of pure nitrogen. In this case the nitrous gas combines with the oxygen of the air, and forms nitric acid, which unites with the water,

and the azot or nitrogen of the atmospheric air is left behind. This is perhaps the easiest and best method of procuring this gas.

From the quantity of azotic gas remaining in the last experiment, and several other examinations, it is inferred that the atmosphere contains about 79 parts in bulk of azotic gas, nearly all the rest is oxygen gas. Mr. Lavoisier first made azotic gas known to the world as a component part of atmospheric air. The experiments were published in 1773. Scheele had before that period procured azotic gas, and shown that it was a distinct substance, though his treatise on air and fire, in which his analysis is given at length, was not published till 1777. But Dr. Rutherford, of Edinburgh, had procured this gas before either of these philosophers; and even before his time it must have been frequently generated during the operations of Chemists, though then all gases were regarded as common air, having different properties, in consequence of some substances which they held in solution. What is the precise use of this gas in the atmosphere, (and we cannot suppose so large a quantity to be there for no purpose), Chemists have not yet succeeded in discovering. It is certain that only the oxygen of the atmosphere disappears both by breathing and by combustion; but at the same time it has been demonstrated, that to breathe oxygen alone is not permanently healthy. No mixture of gases yet discovered answers so well for the support of animal life as that mixture of which the atmosphere consists, and of which a large proportion is azot; and yet, we repeat, the use of this quantity, and the mode in which it operates are not known. Some persons suppose it serves merely to dilute the oxygen; others that a portion of it is inhaled in breathing; and from some late experiments of Dr. Edwards, a physiologist of some celebrity, this opinion seems highly probable. We do not consider, however, that the present is a proper place to enter further into this discussion, as our readers, as far as our own labours are concerned, are yet totally unacquainted with one substance which plays an important part in the phenomena of breathing. We shall postpone this part of our subject till a later period, and were only led to allude to it now in order to induce the young Chemist to direct his researches towards this unsuccessfully cultivated part of the field of Chemistry. But though its use in supporting animal life is not exactly known, its noxious property, as far as this is concerned, has been fully ascertained. Animals obliged to breathe it die very soon, precisely as they would do were they plunged under water. The epiglottis, or door of the windpipe, closes spasmodically whenever nitrogen is applied to it, and the animal dies, not so much because azot is present, but because there is no oxygen. From this property of destroying life, the French Chemists called this substance *Azot*, which is derived from two Greek words, signifying "*destructive of life.*" As this property does not belong to it exclusively, and in fact is possessed more or less by every other gas, its name cannot be considered as well chosen. Some Chemists, therefore, reject this term, and call it Nitrogen, from its being the base of an order of compound substances, some of which are well known, and have long been known by the name of Nitre and its derivatives. It has also been called Corrupted Air, Mephitic Air, and Phlogisticated Air, all of which terms convey an improper idea of its nature. In our present knowledge of this substance, undoubtedly Nitrogen is the most descriptive and most applicable term. However, as Azot is more generally in use than Nitrogen, and was for a short period the only word employed, we shall use both these terms indiscriminately, in order that our readers may constantly recollect they are only different names for the same substance.

Azot has this singularity, that

whenever it unites with those bodies which are called supporters of combustion, no heat and light are emitted. At the same time, a lighted candle, when immersed in it, is instantly extinguished; and if enclosed in a portion of atmospheric air, is also extinguished the instant all the oxygen is consumed. It is, therefore, incombustible in either sense in which this term is used, and for this reason is by some chemical philosophers classed apart from all other substances.

Like common air, it is insipid, inodorous, and invisible, capable of being compressed, and having a constant tendency to expand. It is somewhat lighter than air, its specific gravity being as 969, or, according to some authors, as 972 to 1000. It is not perceptibly absorbed by water, unless the water has previously had the air expelled by boiling, when it takes up about a fiftieth part of its own bulk of nitrogen.

Azot is placed by most Chemists among the negatively electrical elementary bodies; but it is asserted by some Chemists, that it is neither positively nor negatively electrical: and as oxygen stands at the extreme of one pole, and hydrogen at the other, it has been supposed that azot is not a simple substance, but a compound, in equal parts of hydrogen and oxygen. There are, undoubtedly, several reasons for supposing azot to be a compound substance, particularly its formation by the assimilating organs of the body, and numerous attempts have been made to decompose it. Indeed, several distinguished Chemists, misled by some apparent results, have announced to the world, that they had effected this, and that it actually was a compound of oxygen and hydrogen. On these experiments having been repeated, either the same results were not obtained, or they admitted of different explanations. At present, therefore, though there are several reasons drawn from analogy for believing nitrogen a compound; and many phenomena, now involved in obscurity, which would admit of an easy explanation, were it so proved, we are bound to admit that no sufficient proof has yet been obtained of azot being a compound. Till some of the readers of THE CHEMIST, stimulated by a wish to improve the science; or some persons, possessing a more powerful instrument of analysis than any yet known, shall decompose azot, we must continue to class it among simple substances. Some of the compounds of nitrogen are very curious, both in their mechanical qualities and in their effects on the animal organs; but we must refer the consideration of these till we treat of compound substances.

TO DISTINGUISH STONES FOR BUILDING, WHICH ARE LIABLE TO BE AFFECTED BY FROST.

MM. LEPEYRE and Vicat, says M. P. Brard, knowing that I had been occupied in the study of mineralogy as applicable to the arts, engaged me in an investigation of the means best adapted to distinguish such stones, as, being otherwise fit for building materials, gave way to the action of frost. I found it impossible in this respect to ascertain any thing from their mineralogical characters, and was obliged to follow another course. During the winter of 1819, I carefully examined with a lens the chalky limestone of the neighbourhood of Periguex, and the sandstone of the coal basin of la Vezère, both equally liable to this action; I soon found that each scale of the limestone, and each grain of the sandstone was raised by the re-union of small needles of ice, which, when they melted, suffered the particles to fall and collect about the stone, and that where particles had fallen off in this way, a fresh succession was raised in the same manner, and ultimately separated from the mass.

I was struck by the resemblance of the ice in silky crystals to the

saline efflorescences which appear between the plates of certain shists, and on the surface of old walls. I remembered the effect of common salt on bad pottery, and on the saline rocks of the Tyrol, and conceived the idea of substituting the action of a saline solution to that of common water. After various experiments, I gave the preference to sulphate of soda, its effects being the most constant and most conformable to the action of frost.

The experiment, that it may lead to satisfactory results, should be conducted as follows:—Suppose an excavation newly made into limestone and other rocks, and it be desired to ascertain the liability of the rock to disintegration by the action of frost.

1st. A cube of two inches in the side is to be cut from each part to be tried; the various cubes numbered with thick China ink, and their original sites also marked.

2d. About four pints of common cold water is to be saturated with sulphate of soda, so that a few grains of the salt shall remain undissolved.

3d. This solution is to be heated to ebullition, and then all the cubes to be entirely immersed in it. When the boiling has recommenced it is to be continued for half an hour.

4th. The cubes are to be withdrawn from the solution and placed each one in a saucer, numbered as the cube is; a small quantity of the solution is to be poured on to each cube, and the whole left until covered with white efflorescences perfectly analogous in appearance to the rime or hoar frost, which causes the disintegration of the stones. These efflorescences will appear in about twenty-four hours if the air is dry or hot, but in a humid atmosphere are sometimes five or six days.

5th. When the efflorescences appear on the angles and sides of the cubes, they are to be dissolved again by means of a few drops of water, or better still with a little of the solution in which the cubes were boiled. If well managed, the efflorescences will soon reappear, and when well formed, are again to be removed in a similar way, and this is to be repeated for three or four days together;* after which each cube may be washed with abundance of common water, but without removing it from the saucer.

6th. The specimens to be tried having been washed on all their faces, the detached matter is to be examined, and a judgment formed from it, of the relative qualities of each kind of stone submitted to the proof; for the greater the number of the detached particles collected in the saucer, the more liable is the stone to be attacked by frost; the smaller the number, the more capable is it of resisting cold.

As yet, all the results of this test have accorded perfectly with the effect of time and frost. Such stones as have been found to disintegrate by frost have given way to the salt, such as time has sanctioned have resisted the new agent; so that the mechanical effects of the two are perfectly analogous. Crystallization takes place with both, augmentation of volume, efforts on the surfaces of the small cavities containing the water or solution, and if the aggregation be not sufficiently powerful to resist the action, disruption, and a gradual decay of the rocks either in their natural sites, or if they have been applied to use in their new situations. The action of the sulphate of soda being quite mechanical, is exerted indifferently on all kinds of rocks deficient in aggregation, on limestones, sandstones, large-grained granite, granites of too micaceous a structure, shists, lavas, &c. It may be employed as a proof or test also even upon slates, bricks, tufas, mortars, and cements, as is proved by a table of various results of this kind.

* If the proof be continued for a longer period, good building stones may be rejected, for the prolonged action of the salt is more powerful than that of ice.

CHLORATE OF LIME AS A MANURE.

M. Dubuc, an Apothecary, at Rouen, has, since 1820, made repeated experiments with chlorate, or oxymuriate of lime as a manure; and has published the following account of the results. A *kilogramme* of the dry chlorate was dissolved in 60 *litres* of water (or about one pound to eight gallons), and the earth was watered with it both before and after the plants were put in it or the grain sown. Mr. Dubuc then sowed maize in a light soil, watered eight or ten days before with the solution of the chlorate, and he sowed some other maize in a similar situation and exposed to similar circumstances, but watered with common water. The former, which was watered from time to time with the chlorate, grew to double the size of the latter. He also hastened the growth and increased the size of lilacs, and a variety of other shrubs, by watering with the solution of the chlorate. Onions and other vegetables, which already grow to a large size in the neighbourhood of Rouen, were doubled in magnitude by the action of the chlorate. The large annual sun-flower rose, as in Spain, to the height of 15 and 16 feet, while in ordinary circumstances it only rises to the height of six or eight feet. Some of the branches were from three to four inches in diameter, and the leaves were from 18 to 20 inches broad, the disk of the flowers being from 12 to 14 inches in diameter, and the grains yielded the half of their weight of an excellent eating oil. From the centre of the flower exuded a transparent volatile oil, very odorous, and drying easily in the air. M. Dubuc, on May 11th, 1822, planted potatoes of an equal size and weight, in two beds close to each other, being only separated by a walk six feet wide. One of the beds was watered with the chlorate, and the other with water from the cistern; both were dug up in November 1822, and the former had potatoes six inches long, twelve inches in circumference, and weighing more than two pounds; the latter were about half the size and weight of the former. The large potatoes were as good as the small ones, and kept fully as well up to the month of April. They were watered only three times with the solution of the chlorate after they were sown, and their tops surpassed the tops of the others as much as the roots. In general it was sufficient to water the plants with the chlorate three or four times at considerable intervals.—*Ann. de Chim. et Phys.* No. xxv. p. 214.

SULPHUROUS ACID GAS.

M. Berthier shows that this gas may be procured pure and abundant in the following manner:—Heat twelve or fourteen parts of sublimed sulphur mixed with 100 parts of peroxide of manganese in a glass retort, and sulphurous acid gas will come over. The residue in the retort is not (as might be supposed) sulphuret of manganese, but protoxide of manganese, mixed with a little sulphate of manganese, and sometimes a little sulphur.—*Annales de Chimie*, xxiv. 275.

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The Chemist.

"——— Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

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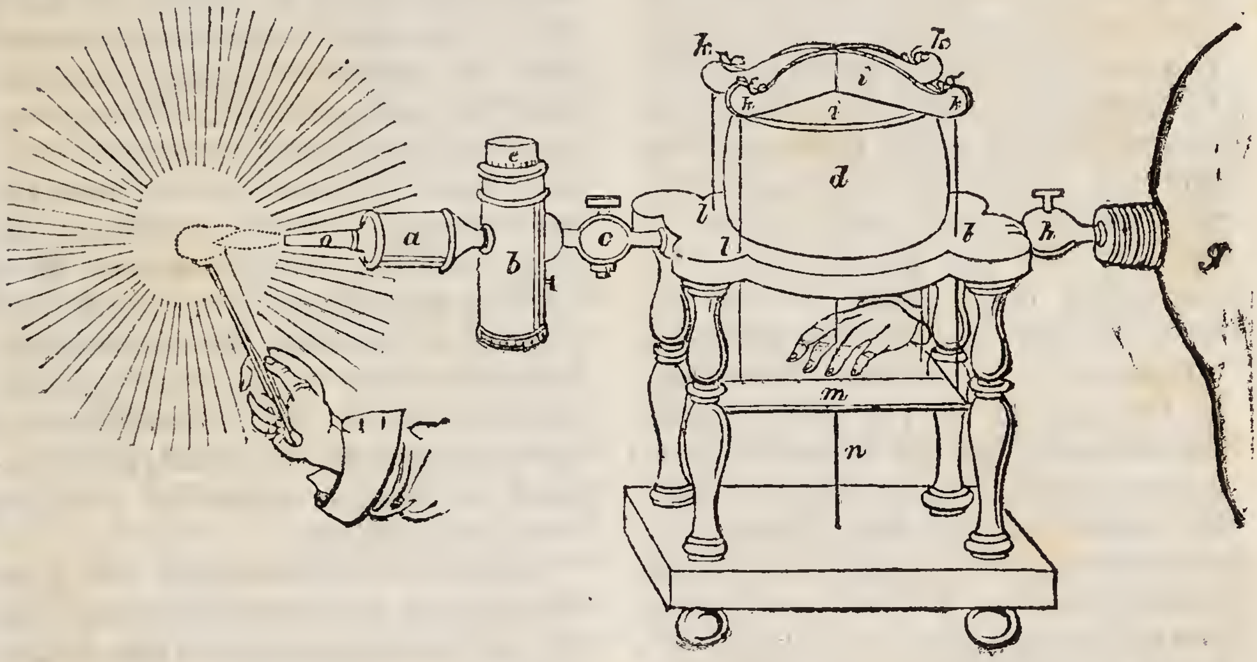


CONTENTS.

CHEMICAL APPARATUS.

Mr. Gurney's Blow Pipe.

THIS Plate represents the oxy-hydrogen blow-pipe, or blow-pipe for propelling a mixture of oxygen and hydrogen, in the proportion of one volume of the former to two of the latter, which is found to act most powerfully, as it has been improved by Mr. Gurney. *a* is a safety apparatus, consisting of a small chamber, to arrest a certain portion of the gas, with layers of wire gauze placed between it and the gasometer, effecting the extinction of the flame by the mechanical force caused by the explosion of the gas in this chamber, thus preventing the explosion of the whole reservoir of gas and securing the operator. It is necessary to make the size of this chamber in proportion to the interior tubes, and to the jet of gas to be used : *b* is a water-trough through which the gas must pass from the gasometer, *d*, by the stop-cock, *c*, and through a tube which reaches to the bottom of the

water; *e* is a cork, which, in case explosion happens on the surface of the water, is thrown up, and which takes out, to admit water to be poured into the trough when first used; *f* a guage, which is to indicate the necessary height of the column of water in the trough; *g* a transferring bladder, which screws and unscrews to and from the stop-cock, *h*, by which the gasometer is charged by an assistant during its action, and the quantity of gas supplied so as to keep up a flame for any length of time. Between the gasometer and the charging bladder there is a valve placed to prevent a return of the gas; *i i* a light pasteboard or wood cap, contrived so as to unite lightness with strength, which in case an explosion of the gasometer happens, is thrown into the air by the force rupturing the strings, *k k k k*, and from its extent of surface and great lightness, it is instantly arrested by the action of the atmosphere. To these strings are attached small wires, which pass through holes in the table of the instrument, *l l l*, and are again affixed to a moveable press-board, *m*, below; this press-board is regulated and kept in a horizontal position by the perpendicular stand, *n*, so that when the necessary weight or pressure is placed on it, it may draw the cap, *i*, horizontally and equally on the gasometer, *d*. The gasometer bladder, *d*, or silk bag, is tied to a bladder-piece, which screws into a long tube, laid into and across the table of the instrument. This bladder-piece, to which the gasometer is tied, permits it to be unscrewed from the table of the instrument at pleasure, and immersed in warm water, to render it soft when occasion requires; or in case an accident happens to it, allows another to be tied on. To one end of the tube, which is let into the table of the instrument, the stop-cock of the charging bladder is attached, and to the other, the stop-cock of the water-trough.

When pressure is made on the press-board, the cap, *i i*, is drawn down on the gasometer, and the gas it contains is forced through the stop-cock, water-tube, and ultimately through the safety apparatus and jet at the end of which it is burnt.

"I generally use," says Mr. Gurney, "my hand to make the necessary force on the press-board, because I can give it any degree of pressure I please, and increase or diminish it as circumstances may require. The force necessary to keep the flame at the ends of the respective jets is known in the first experiment; for when it is too little, or the hand is taken off from the press-board, the flame returns into the safety chamber and the gas is extinguished. Whenever you wish to suspend the operation, and take off the hand from the press-board for that purpose, the water in the trough serves as a 'self-acting valve,' in preventing all escape of gas from the instrument, and saves the trouble of turning the stop-cock. When weights are used instead of the hand, the stop-cock of course must be used in every operation.

"Jets of various sizes are provided, and screw occasionally into the safety apparatus, at the will of the operator. When large ones are used, a little water will sometimes come over with the gas; to prevent this, I have attached to the under end of the tube which is inserted into the water, a little silk tube or bag, which swims through the water to the surface, thus making a passage for the gas through it, without a possibility of splashing the water. When pressure is taken off the press-board, the weight of water collapses and presses the sides of the silk tube together, and prevents the escape or waste of gas, without the necessity of turning the stop-cock for the purpose. But feeling confidence in the safety of the instrument, I generally remove the water-trough entirely, and screw the safety apparatus immediately on to the front stop-cock, by the addition of a common connecting piece, when I wish to use a very large jet for any particular purpose."

CHEMISTRY AS A SCIENCE.
Art. VIII.
CARBON.

CHARCOAL is a substance with which most of our readers must be familiar. It is the first simple substance we have yet mentioned which has not been discovered in modern times. Charcoal was well known to the ancients; and charcoal, when pure, is only another name for *carbon*. It is obtained by burning any sort of vegetable matter, but particularly wood, in a close vessel. On a large scale it is manufactured by placing a great quantity of wood in a heap, setting it on fire, and covering it up with sand and clay, or charcoal powder and ashes. Whatever wood may be used, the charcoal, provided it be sufficiently burnt, possesses the same properties. By common burning all the volatile substances, peculiar to different kinds of wood, are not expelled; and, therefore, to procure it pure, common charcoal must be exposed for an hour in a covered crucible to the heat of a forge. It is a black, shining, brittle substance, without either taste or smell. It is insoluble in water; and, if all air and moisture be excluded, is no otherwise affected by the most violent heat which can be applied to it, than to become harder and more brilliant. It is an excellent conductor of electricity, and a very bad conductor of heat, which makes it of considerable use in lining crucibles. It is insoluble in water, and not liable to corruption. Hence arises the utility of charring the outside of stakes to be driven into the ground. This property of charcoal was well known to the ancients, and in our own time wood has been discovered which has been preserved sound from the time of the Romans, by the outside having been charred. It is of great use in correcting the smell and taste of different substances. If new made charcoal be rolled up in clothes which have contracted a disagreeable odour, the charcoal effectually destroys it. If boiled with meat beginning to putrify, it destroys the bad taint. It is an excellent tooth-powder. If powdered charcoal, equal to about one-ninth of the weight of any quantity of water, beginning to putrify, be added to it, the water is rendered quite sweet. Hence arises the utility of charring the inside of water casks intended to contain water for a long period. It is the slow decomposition of the wood in contact with the water, or owing to the decomposition of some substance the water holds in solution, which imparts to it the disagreeable taste and smell it sometimes acquires in long sea voyages. Though charring the inside of casks does not cut off this latter source of putrefaction, it cuts off the former, and is found of considerable service. The practice of employing iron tanks to keep water which has lately been introduced on board ships, is not only economical, but also preserves the water from one cause of putrefaction.

New made charcoal absorbs moisture with great avidity, so as to increase in weight, if left in the open air, about twelve and a half per cent. When entirely freed from air, by being exposed either to a great heat, or to the action of the air-pump, it has the singular property of absorbing a precise and determinate quantity of the different gases. The most complete and satisfactory set of experiments on this subject were made by M. Theodore Saussure. The charcoal he employed was that obtained from box wood, and he found great differences in the quantity of gas absorbed. Thus one volume of charcoal absorbed 90 volumes of ammoniacal gas, 85 of muriatic gas, 65 of sulphurous acid gas, nine and a quarter of oxygen gas, and only one volume and three-quarters of hydrogen gas. The absorption was completed in twenty-four hours, and was not increased by allowing the charcoal to remain longer in contact with the gas. The most scientific chemists suppose that this effect is analogous to that power of small tubes called capillary attraction, by which fluids

rise in them to a certain height. But if this be the case, how are we to explain Professor Dobereiner's experiment, recorded in our last. From that he infers that the particles of hydrogen are smaller than those of the other gases; and on this principle, supposing the absorption of the charcoal to be oc-occasioned by capillary attraction, more hydrogen should be absorbed than either of the other gases, while the reverse is the case. Fifty times more ammoniacal than hydrogen gas is absorbed. The fact of the absorption is curious, and its taking place in determinate proportions would lead us to suppose that it must be owing to a chemical, rather than to a mechanical action; particularly as the charcoal, if put into another gas, will give out a portion of that which it has already taken up, and will absorb a portion of the new gas.

It has already been stated that charcoal is not altered by exposure to heat, if air and moisture be excluded: but if air be admitted, it becomes red hot at about the temperature of 800°, and continues to burn (supposing it pure) till it is totally consumed. The air in which this combustion is carried on is so much altered by it, that if animals breathe it, they die. If small pieces of dry charcoal be placed on a pedestal, in a glass jar filled with oxgen gas, they may be kindled by means of a burning-glass, and consumed. If the gas be afterwards examined, it will be found not altered in quantity, but materially altered in its properties. Lime water, when allowed to pass into the jar, becomes turbid and milky, and absorbs a portion of the gas. The gas thus absorbed is called carbonic acid gas; and M. Lavoisier proved that it is precisely equal in weight to the charcoal and oxygen which disappear during the combustion. He therefore concluded that the carbonic acid is a compound of charcoal and oxygen, and that the combustion of charcoal is nothing else but its combination with oxygen.

There are, perhaps, no two substances of which the mechanical properties are more different, and even contrary, than diamond and charcoal. The diamond is the hardest and most beautiful of the precious stones, and is so extremely rare, that immense sums of money are given for small specimens. It is a beautiful little crystal, dazzling the eye by its brilliancy and its lustre. In its appearance and texture it is the very reverse of charcoal. It is also a non-conductor of electricity, while charcoal is a very good conductor. For many ages it was considered impossible to burn diamond; but Sir Isaac Newton, with that unerring sagacity which seems to have distinguished him beyond all other scientific men, conjectured from its property of refracting light so powerfully, that it would burn. He had observed that, in general, bodies were combustible in proportion as they refracted light, and hence he was led to conjecture that the diamond was combustible, and that even water contained a combustible principle. Both these conjectures have been amply verified. It has been ascertained that water is composed of hydrogen, which is one of the most combustible materials; and in 1694, the Florentine academicians consumed several diamonds by means of burning glasses in the presence of Cosmo III. Grand Duke of Tuscany. Since that period this experiment has been frequently repeated; and it has been found, by Sir George Mackenzie, that diamonds will burn, at a temperature below that required for melting silver. When placed in what is called a muffle, a little earthen-ware oven, fitted into a furnace, if a strong heat is applied to them, they burn with a low flame, increasing somewhat in bulk, and having their surface covered with crusts of charcoal. This latter effect is particularly observed when they are consumed in close vessels, by means of burning glasses.

It was soon ascertained that if air was excluded, the diamonds underwent no change; and Lavoi-

sier proved that the product of the combustion in air or in oxygen gas, was carbonic acid gas. His experiments have since been frequently repeated, and others have been instituted with a view to ascertain the fact: Mr. Smithson Tennant put 120 grains of nitre, and 2.5 grains of diamond into a tube of gold, and kept the mixture in a red heat for half an hour. The diamond was consumed by the oxygen which the nitre gave out; the carbonic acid formed was combined with lime, and afterwards separated and measured. It was found to be 19.36 inches in bulk, and to weigh 9 grains; these, according to Lavoisier's calculation, should contain 2.5 grains of carbon, which was the exact weight of the diamond employed. The proportion of carbonic acid produced from the combustion of the diamond being about equal to what would have been afforded by the same weight of good charcoal, it was concluded that diamond and charcoal were the same substance. Common sense rather demurs to this conclusion. There are few or no instances of the different hidden properties of matter not being in some measure indicated by their palpable and evident properties. Much has been stated in various systems of philosophy, and, in our opinion, very erroneously stated, of the delusion of the senses; the fact being that our senses never delude us, though the conclusions which men draw, and the things they imagine, very often delude them; but it would indeed be a delusion of the most decisive nature if the chemical, which are the hidden properties of two such different substances as charcoal and diamond, were found to be precisely the same. The experiments of M. Lavoisier and of Mr. Tennant, have since been repeated by Messrs. Allen and Pepys, and by Sir Humphry Davy, and the conclusion now drawn is, that diamond and charcoal have very nearly the same base. A closer examination has taught Chemists that charcoal always contains a small portion of hydrogen. When chlorine is passed through charcoal, which has been previously exposed to a very strong heat, muriatic acid is formed. When charcoal is burnt in dry oxygen gas, moisture is always formed. By exposing charcoal in *vacuo*, and in condensed azot, to an intense heat, by means of the voltaic battery, Sir Humphrey Davy found that a small quantity of hydrogen was produced, and the remaining charcoal became so much harder than before, that it scratched glass, while its lustre was considerably increased. While this beautiful experiment almost pointed out the mode by which diamonds may be formed, it also distinctly proved that charcoal differs in its chemical properties from diamond, by containing hydrogen. When charcoal is burnt, there is water formed besides carbonic acid; but when diamond is consumed, carbonic acid gas is the sole product.

Carbon is very widely diffused through nature. It forms a very large portion of the vegetable kingdom, and enters largely into all those substances—such as sugar, gums, resins, oils, &c. which are manufactured from vegetables. Under a particular form, a portion of it is constantly given out by all animals, and is generally absorbed by vegetables. It is the basis of that inexhaustible fund of fuel which makes our homes not only comfortable, but habitable, and which more than any other product of our country, except the people, has contributed to our national wealth. In the mineral kingdom, it forms a part of every variety of lime-stone and of marble, and thus enters largely into those material substances which form the crust of the earth.

There is one substance, however, of which it forms so large a part, that we cannot omit mentioning it more particularly, this is black lead, or as it is otherwise called, *plumbago*, or *graphite*. This is a mineral substance, the finest specimens of which are found in the celebrated mine of Borrowdale, in the

county of Cumberland. The present is not the proper occasion for entering into its history, as it is, properly speaking, a compound, and as such will be hereafter described. It is a well-known substance, and is largely employed in the arts, supplying us both with crucibles and pencils: it is now mentioned from its being almost wholly composed of carbon, and from some late experimenters having succeeded in forming crystals as hard as diamonds, by exposing it to strong fusion. Black lead, which is a very improper name, is, in fact, a carburet of iron, and contains about 91 parts carbon, and 9 iron. When burnt with dry oxygen gas, moisture was deposited, which shows that, like charcoal, it contains hydrogen. This substance was lately fused by the blow-pipe, and the result was numerous globules of matter having a high vitreous lustre, and considerable beauty. Some of them were of jet black, like the most perfect obsidian; others were brown, yellow, and topaz coloured; others were greyish-white, like pearls, with the transparency and lustre of porcelain; and others were limpid like flint glass, or, in some cases, like the opal. They were so hard as to scratch flint glass, window glass, and the hard green variety out of which aquafortis bottles are made. Some of the globules were scarcely to be distinguished by the eye from diamonds. We have, therefore, in this experiment on the soft and greasy substance, black lead, as in Sir Humphrey Davy's experiment before mentioned, on charcoal, a proof of the great chemical similarity between diamonds, plumbago, and charcoal; but we have also in the other experiments and results which have been mentioned, a decisive proof that they are not precisely the same, for both plumbago and charcoal are combined with hydrogen.

TO MAKE RANCID BUTTER FRESH.

We beg leave to recommend the following request to the notice of our readers; and we subjoin at the same time one answer, though we cannot say that this method is an *easy* one. However, we have no doubt that some of our Correspondents will be able to give our inquiring friend more information.

"The Editor of the Chemist will much oblige a subscriber and sincere well-wisher, if he or any of his Correspondents can point out an easy mode of restoring rancid butter, so as to render it fit for use.

"April 14, 1824."

Melt the butter over a slow fire, or by means of a water-bath, at a heat not exceeding 180° Fahr., and remove the scum as it arises. Continue the operation till all the matter that will subside to the bottom has done so, and the butter is transparent. Then decant it or strain it through a cloth, and cool it in a mixture of pounded ice and salt, or in cold spring water, otherwise it will become lumpy. When cool, it will not have entirely lost its rancidity, but it will be much improved. If afterwards well washed with pure water or with ardent spirits, or, still better, with a small quantity of sweet milk, its taste will be found much, if not wholly corrected.

GALLIC ACID CONVERTED INTO ULMIN.

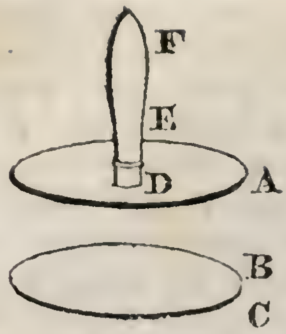
Ulmin is a curious substance, exuding from some trees, and resembling gum, in some respects, but is not, like it, sticky and capable of being formed into a paste. Gallic acid is also a vegetable substance, found in the parts of many plants, but more particularly in nut-galls, from which it is named. Professor Döbereiner lately found, on dissolving a determinate quantity of gallic acid in ammonia, and placing the solution in contact with oxygen, that it absorbed sufficient to convert all the hydrogen of the gallic acid into water. By this abstraction the gallic acid became converted into ulmin, which, the Professor says, may be represented as a combination of two volumes of gaseous oxide of carbon, and one volume of vapour of water.

ILLUSTRATION OF THE PRINCIPLE OF THE SAFETY LAMP.

Take a single thread of cotton, immerse it in oil, and allow it to burn, by means of a cork float, immediately on the surface of the oil. The flame will be about one-thirtieth of an inch in diameter. Take a fine iron wire, about one hundred and an eightieth of an inch in diameter, form it into a ring of a tenth of an inch in diameter, and place it over the flame. Though there is a considerable space between the flame and the ring, if the latter be cold the former will be instantly extinguished; but if it be held above the flame, so as to be slightly heated, it may be passed over the flame without extinguishing it. This depends on the power of the metal to abstract the heat of the flame. Sir H. Davy employed a glass ring of the same diameter and size as the iron ring, which, being a bad conductor of heat, did not extinguish the flame even when cold: but when a thicker glass was employed, and the ring made of a smaller circumference, it acted like the iron wire, and extinguished the flame, unless heated. Again, if a small globe of metal, one-twentieth of an inch in diameter, made by fusing the end of a wire, be brought near the flame of a single thread of cotton, such as above described, it will, when cold, extinguish it at the distance of its own diameter. Let it be heated, and the distance at which it operates will be diminished in proportion. These experiments show that small metallic apertures, which admit both light and air, will extinguish flame; and on this principle Sir H. Davy surrounds the miner's candle with a case of metallic gauze, and the flame is prevented, even when in contact with an inflammable gas, from proceeding beyond the gauze.

BIOGRAPHICAL NOTICE OF BECCHER, AN EMINENT CHEMIST.

In the middle of the 17th century, when alchymy, owing to the numerous tricks of the alchymists, and to the conviction then gaining ground, that to hunt after the philosopher's stone was philosophic folly, was falling into disrepute, there was a danger that the numerous discoveries made by the alchymists, and the facts known to them, should be forgotten or lost to the world for ever. The bad character of the professors had extended itself to every thing connected with them; and rational persons, despising their tricks, were disposed to reject even their knowledge. At that time there arose a man, thoroughly acquainted with all the facts which had been discovered by the alchymists, capable of arranging them, and who, at the same time, knew some of the important purposes to which they might be applied. This man was John Joachim Beccher, who seems to have been of Jewish extraction, and was born at Spiers, in the year 1625. He was first a professor of medicine; then physician to the Elector of Mentz; and afterwards lived at the court of Bavaria in the same capacity. Towards the close of his life, he came over to England, and died at London about 1682, it is supposed, in great poverty. This man is considered to have collected, from amidst the rubbish and gems of the alchymists, the materials for the foundation of the present science of chemistry. In a work which he published at Frankfort, in Germany, in the year 1669, entitled, *Physica Subterranea*, he pointed out the use which might be made of the discoveries of the alchymists, and the proper objects to which the researches of chemists ought to be directed. The publication of his work forms a very important era in the history of chemistry; and chemists having since then pursued the path which he indicated, have brought the science to its present state. Perhaps the world may regret that so little is known of this celebrated chemist; but the fame of Beccher, like that of most of the early improvers of science, rests entirely on the single work which bears his name.



THE ELECTROPHOROUS OF VOLTA.

(*In answer to a Correspondent.*)

A Correspondent, some time ago, requested to be informed of the best manner of making an electrophorous. We are not aware that any other or better method has been discovered than that of the inventor of the instrument, the celebrated Volta. Our Plate represents the form of his electrophorous. A is a circular plate of metal, or piece of wood, covered with tin foil, which has a glass handle, F, screwed into a brass or wooden nut, D. The edge of this plate must be pretty thick, and well smoothed and rounded off. The lower plate, B, consists of a resinous cake, and another metallic plate. The resinous cake is formed by melting together equal parts of shell lac, resin and Venice turpentine; and it may either be poured, when fluid, on the metallic plate, if it be provided with a rim, or it may be poured on a marble slab, from which it can be easily separated, when cold, and applied to the metal. Of the three plates, A is called the *upper conductor;* B the resinous plate; and C the lower conductor. We presume our Correspondent does not require us to describe the uses of this instrument; and that he knows it is an electrical machine, about 20 sparks from the upper conductor being sufficient to charge a small Leyden phial.

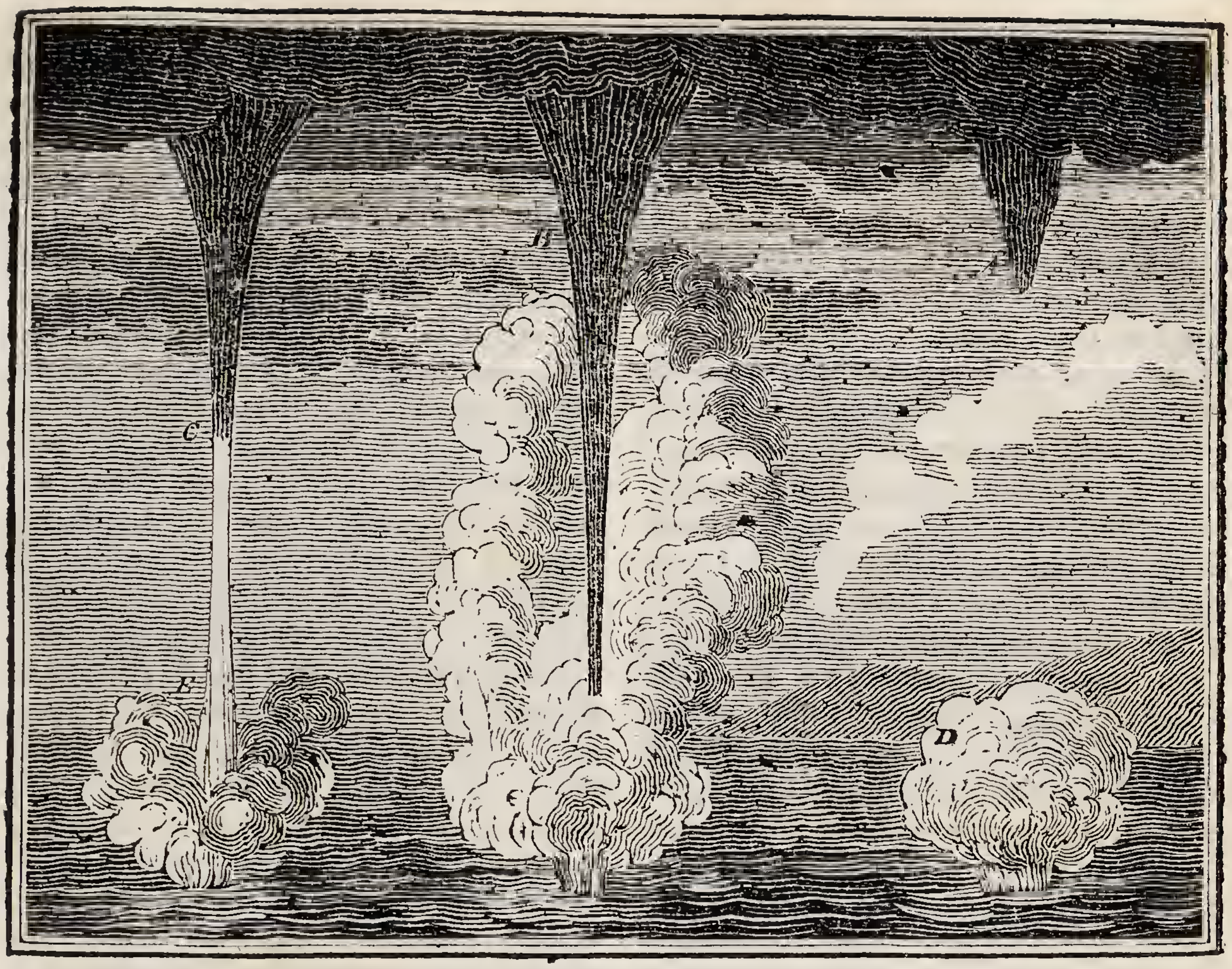
ECONOMICAL PREPARATION OF PURE OXIDE OF NICKEL.

Speiss, or impure nickel, is to be reduced to fine powder, and roasted till it gives off no further vapours of arsenic, the heat being at first moderate, to prevent fusion, and then increased. Metallic iron, in the state of filings or nails, is to be added in a quantity which ought previously to be determined, and the whole dissolved in boiling nitro-muriatic acid, so much nitric acid being used that no protoxide of iron remain in the solution; evaporate to dryness and re-dissolve in water, when a large quantity of arseniate of iron will be left. Add to the solutions successive portions of carbonate of soda until a greenish precipitate appears, at which time all the arsenic and iron will be separated, and part of the copper; the rest of the copper may be separated by sulphuretted hydrogen, and the clear solution thus obtained, when boiled with sub-carbonate of soda, yields the carbonate of nickel.

Thus obtained, the carbonate of nickel contains a little cobalt; to separate the latter, the precipitate, as obtained above, by boiling with sub-carbonate of soda, is to be well washed, and diffused whilst moist in water, and a current of chlorine passed into it until in excess: the excess of chlorine is to be allowed to dissipate, and the solution filtered; it now contains not the smallest trace of cobalt, that remaining as a hydrated peroxide, with a certain portion of nickel in the same state. If in the mixed carbonate of nickel and cobalt, the latter is in excess, the residue, after the action of the chlorine, is pure hydrate of cobalt, and the solution contains the nickel with a small quantity of cobalt.—*Ann. de Chim.* xxv. 95.

NEW PYROPHORUS; OR, INSTANTANEOUS FIRE-LIGHTER.

In determining the composition of tartrate of lead, Dr. Friedman Gobel, of Jena, observed that this salt, when heated in a glass tube, formed a fine pyrophorus. When a portion of the deep brown mass is projected from the tube, it instantly takes fire, and brilliant globules of metallic lead appear on the surface of the substance in ignition. The effect continues much longer than in other pyrophori.



WATER-SPOUTS.

To the Editor of The Chemist.

SIR,—Among the meteorological phenomena which have long excited the attention and inquiries of philosophers, none seems involved in more darkness and obscurity than that of water-spouts. As your Journal is devoted to scientific subjects, and as this as well as most other meteorological phenomena, fall within the department of Chemistry, and can only be explained by chemical principles, I trust you will allow me to present your readers with a description of these phenomena, and afterwards to offer a few words in explanation.

A full explanation I hold to be impossible, till it is clearly ascertained what are the changes which water undergoes when taken into the atmosphere; how it is disposed of when there; and what occasions it afterwards to form and fall. Your readers, acquainted with meteorology, well know that these are doubtful points, which science has not yet fully investigated. My observations will rather tend to put other persons in the right path of inquiry, than to set the question at rest. If you think them worthy of insertion in your Journal, you will gratify a constant reader, and an OLD SAILOR.

Your readers doubtless know, that water-spouts are dark black clouds, of a funnel kind of shape, which descend from above to the sea, and which are supposed to convey water into the atmosphere. The drawing I send represents them as they generally occur. At their first formation, they appear, according to Capt. Maxwell's account, as at A, where the black cloud *drops* from a level surface into a conical form *before* the disturbance at the surface of the sea, as shown at D, is observed. The effect produced at D is like that of a smoking furnace. The black conical cloud now continues to descend, as shown at B, till it almost reaches the surface of the sea, and the smoke-like appearance rises higher and higher, till it forms a union with the cloud, from which the spout appears to be suspended. In this situation it is said to put on its most terrific appearance to the mariners who have the misfortune to be in its neighbourhood. When the spout begins to disperse, it as-

sumes the appearance shown at C. The black cloud generally draws itself up in a ragged form, but leaves a thin transparent tube, C E, which reaches to the water, where the smoke-like commotion still prevails. At this time there is a curious motion in the upper part of the tube.

Another witness says, it was observable of all of them, but chiefly of the large pillar, that, towards the end, it began to appear like a hollow canal, only black in the borders, but white in the middle; and though at first it was altogether black and opaque, yet one could very distinctly perceive the *sea-water to fly up along the middle of this canal, as smoke does up a chimney, and that with great swiftness and very perceptible motion;* and then soon after the spout or canal burst in the middle, and disappeared, by little and little, the *boiling up* and the pillar-like form of the sea water *continuing always the last*, even for some considerable time after the spout disappeared, and perhaps till the spout appeared again, or reformed itself, which it commonly did at the same place as before, breaking and forming itself again several times in a quarter of an hour.

Captain Napier thus describes one which he saw, on Sept. 6th, 1814, in lat. 30° 47′ N., and long. 62° 40′ W.:—"The wind being variable, between N.N.W. and N.N.E., the ship steering S.E., an extraordinary sort of whirlwind was observed to form, about three cables' length from the starboard bow of his Majesty's ship Erne. It carried the water up along with it in a cylindrical form, in diameter, to appearance, like that of a water-butt, gradually rising in height, increasing in bulk, and advancing in a southerly direction. At the distance of a mile from the ship it continued stationary for several minutes, boiling and foaming at the base, *discharging an immense column of water, with a rushing or hissing noise*, into the overhanging clouds, turning itself with a quick spiral motion, constantly bending and straightening, according as it was affected by the variable wind, which then prevailed from all points of the compass. It next returned to the northward, in direct opposition to the prevailing wind, and right upon the ship's starboard beam, whose course was altered to east, in hopes of letting it pass a-stern. Its approach, however, was so rapid, that we were obliged to resort to the usual expedient of a broadside, for the purpose of averting the danger; when, after firing several shots, and one in particular having passed right through it, it appeared for a minute as if cut horizontally in two parts, the divisions waving to and fro in different directions, as if agitated by opposite winds, till they again joined for a time, and at last dissipated *in an immense dark cloud or shower of rain.* The *near edge showered in large heavy drops on the ship's deck, till the cloud was quite exhausted.* At the time of firing the gun, its base covered a portion of the surface of the water, equal to *half a furlong*, or 300 feet in diameter, while the cloud itself extended over head and all round to a very considerable distance. There was *never much wind*," Capt. Napier adds; "and the water that fell from the cloud and was caught in the foot of the driver (a sail) was *perfectly fresh.* Low heavy black clouds were hanging about, occasional drops of rain followed, the mercury in the barometer became considerably more convex, and was *followed by a clear atmosphere and hot sultry weather.*"

(*To be continued.*)

LECTURES ON CHEMISTRY, AT THE MECHANICS' INSTITUTION.

It was impossible for us in our last Number to do any thing more than merely notice Mr. Phillips's first Lecture; and we were, therefore, obliged to postpone to a better opportunity laying an outline of it before our readers. Mr. Phillips began by bespeaking the attention of his hearers, making an apology for using some terms which might probably be unknown

to them, and describing these terms as the tools with which he worked. He then proceeded to explain that all the changes which take place in the objects about us, that are unaccompanied by sensible motion, were the results of the union or separation of two or more substances, which he characterized as unalterable elements. The objects of Chemistry he explained to be an inquiry into the constituent elements of bodies, and to ascertain the laws of chemical changes. Of some substances the different *natural* properties (meaning the commonly observed properties, we presume) are found to be a correct index to their different chemical properties; of others the reverse is the case. Thus charcoal or carbon differs as much in appearance as in its chemical properties from potash; but it differs still more in appearance from the diamond, though its chemical properties are found to be very nearly or precisely the same. To ascertain chemical properties, two modes are had recourse to. Or chemical researches are carried on both by analysis and synthesis. Thus by applying either heat or a strong acid to marble, which, in the language of chemistry, is carbonate of lime, it is separated into the two substances, lime, and carbonic acid, each having very different properties from the marble. This is the analytical mode of investigation. If the carbonic acid gas, disengaged from a piece of marble, is conveyed into a solution of lime, the carbonic acid gas unites with the lime, and again forms a substance, having the chemical, but not exactly the mechanical properties of lime. This is the synthetical mode of examination; and when the two modes exactly correspond, chemical research is complete and correct. The professor disengaged the carbonic acid gas from a piece of marble, by the action of muriatic acid, and he conveyed this same gas into a solution of lime-water, and there re-formed a carbonate, illustrating his doctrine by a very appropriate and beautiful experiment. There are only a few cases, however, in which the Chemists' art can reproduce the substances he has destroyed. Of these few, water furnishes one of the most striking examples. By analysis it is separated into oxygen and hydrogen, and by synthesis this oxygen and hydrogen are again formed into water. The Chemist can, in many cases, reproduce bodies with the same chemical, which have not, however, the same mechanical properties. All the bodies of nature, of whatever description, are composed of two or more of the elementary substances; those only being called elementary substances which the Chemists' art has not decomposed; and this art frequently proves that the substances which are called elements by one generation of Chemists, are by the next shown to be compounds. Thus only a few years ago lime was regarded as a simple substance; but the experiments of Sir Humphrey Davy showed that it was a compound of metal, which he called *calcium* and *oxygen.* Having thus shown to his audience the two modes of chemical investigation, and explained what was meant by a simple or elementary substance, and enumerated those at present known, the Professor proceeded to sketch the outline of the course he was to deliver. We were not so fortunate as to comprehend exactly either the principles or the details of his arrangements; but we understood him to say, he should first explain the laws of chemical action, and then treat of the simple substances or agents, which are imponderable, such as light, heat, and electricity, and afterwards of those which are ponderable. He then proceeded to explain and illustrate chemical action.

Chemical action is produced by chemical affinity, and is known by the alterations which take place when two or more bodies are brought into contact. The chemical action of two bodies is supposed to be mutual and equal. Thus when lime unites with muriatic

acid, giving out its carbonic acid, the affinity of the lime for the muriatic acid is equal to that of the acid for the lime. The difference between chemical affinity and cohesive affinity is, that the former exists between the particles of dissimilar bodies, and the latter between the particles of the same body. Thus the particles of iron are united into masses by cohesive affinity, and the muriatic acid or carbonic acid combines with lime by chemical affinity. Chemical action is accompanied by several remarkable circumstances; one of the most conspicuous of which is an alteration of temperature. Thus by mixing sulphuric acid and water, such a quantity of heat is given out, that ether boils by being immersed in the mixture. The Professor mixed sulphuric acid and water, and plunged in it a small glass tube containing ether, which almost immediately boiled up so as to be perceptible in every part of the chapel. He then mixed sulphate of soda, we believe, with nitrat of ammonia; the two combined, and so great a degree of cold was the consequence, that a small portion of water contained in a glass tube was frozen, to the admiration of all the spectators. Here, then, was the proof of change of temperature accompanying chemical action. But this is not the only accompanying circumstance. The sulphuric acid, diluted with water that gave out heat, at the same time diminishes in volume; so that if measured after being mixed, the combined substance would be found to occupy less space than the two did when separate. This may be considered as an approximation to the solid form; and on the other hand, when the change is from solidity to fluidity, cold is produced. A change of form also very generally accompanies chemical action. Fluids become solids, and solids become fluids. Nay, even two imperceptible gases when united form a solid. The Professor placed some volatile akali in one flask, and muriatic acid in another; he adapted one end of a glass tube to the mouth of each flask, and he passed the other end of both into the opposite ends of a glass cylinder; the heat of a spirit lamp was then applied to the bottom of each flask, and the invisible vapour arising from the ammonia and from the muriatic acid meeting in the glass cylinder, became immediately white and flaky, so that the cylinder, from being transparent, was soon rendered opaque, and there was found a white flaky substance deposited at the bottom. This substance was sal ammonia. The Professor then illustrated chemical action, by the effect of air on iron; and stated that when iron rusted, only the oxygen of the atmosphere was absorbed, while the rust had hardly any of the properties of the metal; that it was specifically lighter, had no longer any lustre, and was not attracted by the magnet; he then beautifully remarked that this rusting of iron must have been perceived from the earliest ages, and, if attended to, would have led to the discovery of the compound nature of the atmosphere, and not have allowed this gem of science to have remained undiscovered till the eighteenth century. Another circumstance which frequently attends chemical action, is change of colour. Two pieces of copper were plunged in nitric acid, which after a short time, became of a deep blue, owing to the decomposition of the copper. Prussian blue was precipitated by a mixture of two fluids that were almost colourless, which was an instance of a coloured solid produced by mixing two colourless fluids. A piece of indigo was plunged in a solution of chlorine, and became perfectly colourless. This was a good illustration of of the bleaching power of this substance; and Mr. Phillips remarked, that by introducing it into bleaching, this operation was now performed in a few square yards, and but for this discovery it would have required as many acres. Chemical action or union is further accompanied by a total change of character, and

sometimes by a change which, prior to experience, it was impossible to imagine. Thus sulphuric acid and potash, both dreadfully acrid substances, destroying our clothes and flesh, when applied to them, become, when united, sulphate of potash, a harmless, almost tasteless salt, and so little acrid that it is employed as a medicine. Another circumstance which sometimes accompanies chemical action, was detonation; this effect the Professor showed by making use of a small quantity of detonating silver; but this phenomenon was one, which, from the danger of the experiment and of examining it, was not yet fully explained. The following, therefore, were the circumstances which he described as accompanying chemical action:

Change of temperature;
Change of volume;
Change of form;
Change of colour.

The subject, we understood, is to be continued.

In conclusion we must observe, that we are extremely well pleased that the Mechanics have obtained so able a Lecturer. Mr. Phillips is distinct in his enunciation; he is a neat and skilful experimenter, and he was careful to repeat every sentence which had the character of an axiom. The zeal and attention which his audience displayed; the well-merited applause they bestowed on various parts of his discourse; and the repeated clapping of hands which were heard at its close, must have convinced him that his pupils were highly delighted, and that they merit his care. For their sakes, we could have wished that a more rigid logic had been observed by Mr. Phillips in his division of the subject, and in some of his expressions. In one part of his Lecture, he spoke of fire as a simple substance; and in another, described light and heat, which constitute *fire*, as distinct substances. That they are distinct and separate, whether called agencies or substances, is abundantly evident. The *warm* breeze from the south brings no *light* with it; on the contrary, the *flash* of the gun is seen even far beyond the range of the shot it hurls on a foe. We see a vivid streak pass rapidly through the clouds, but know not, till the bolt falls on our houses, that it has been accompanied by heat enough to melt iron. Light affects only the *eye;* is imperceptible by any other organ; and, perhaps, the eye is the only part of the body that does not convey to us the sensation of heat or cold. Heat and light, therefore, are perfectly distinct; and *fire*, which in common language signifies a union of both, should never, even for a moment, be spoken of by scientific men as a simple or undecompounded substance.

We beg leave also to suggest to Mr. Phillips, that chemical properties are as much natural as any other properties. They are all natural, and one part of the whole ought not to be placed in contrast or opposition with the other. The chemical properties of bodies are distinguished from their mechanical properties, or from those which are commonly and generally observed, as their weight, colour, and texture; but both the mechanical and chemical properties of bodies are equally natural.

Again, we are not quite clear as to Mr. Phillips's distinction between chemical affinity and cohesive affinity. The former being, according to him, the affinity between the particles of different substances; the latter, that power which combines the particles of the same substance into masses. But copper and zinc are different substances; and, according to Mr. Phillips's definition, should only be sensible to chemical affinity; but they, as well as all the metals, when alloyed together, and many other different substances, can exist combined together into masses. The very substance Mr. P. was operating on should have dictated a different, or at least a more cautious language. Carbonic acid and lime are surely very different substances, but they exist combined into masses. Nay, lime,

when pure, assumes the character of a powder; and it would seem necessary, that the acid, or some other different substance, should be combined with it to give it solidity. Cohesive affinity is not, therefore, confined to the particles of the same substance, but belongs also to the particles of different substances; and there is no ground for the distinction which Mr. P., in imitation of other Chemists, laid down.

We make these few remarks in no spirit of hostility to this excellent Lecturer, but merely to put him on his guard, that he may not be led away by the *slang* of scientific men. It is incumbent on those who teach, to do it honestly and conscientiously. They are liable, of course, like their scholars, and other men, to numerous errors; but they are bound, at least, to *think* what they teach, to have an honest conviction of its truth, and not to repeat, like parrots, the words they may have heard. We should make a much more rapid progress in knowledge, were those who make it their business to instruct us, only to give themselves the trouble to examine the meaning of the words they repeat to us.

SECOND LECTURE.

We attended the second Lecture of Mr. Phillips, on Wednesday last, and are pleased that we can say as much in praise of it, as we have already said of the former. The Lecturer enters at once with spirit into his subject, having about him none of the dandyism of science, and desirous only freely and frankly to impart instruction. Referring to his former Lecture, he said, he had partly explained chemical action, and had shown that no matter was lost. Combustion, which appeared the consumption of a body, in fact, converted it into a gaseous product; and it was possible that the coal which we now consumed might hereafter return to the same state, and by its renewed combustion warm future generations. He before explained the circumstances which accompanied chemical action; he would now advert to some circumstances which modify and control it. Heat, he showed, modifies it. Thus there are some substances which have no effect on others, unless a considerable degree of heat is applied; when this is the case, they decompose them. He illustrated this general fact by several experiments, only one of which we can mention. Oxygen and hydrogen gases were mixed in the requisite proportion to form water, but they had no effect on each other till flame was applied to them, when they instantly combined, with a loud explosion. Another circumstance which modifies chemical action, is the cohesion of bodies. Nitric acid, for example, has no effect on adamantine spar, or common-pipe clay, both of which are nearly the same substance, chemically speaking; but if the cohesion of these substances is destroyed, as it is by their being combined with some other substance, then they will combine with nitric acid: thus showing that the attraction of cohesion modifies chemical action. Marble is more quickly dissolved, if first reduced to powder, because a larger surface comes in contact with the solvent. The same principle explains why agitation promotes chemical action. A piece of blue vitriol, in water, coloured only the water immediately above it, but by stirring it the whole water came in turn in contact with it; the blue vitriol was more rapidly dissolved, and the whole of the water was coloured. It is sometimes the case that the chemical action of two substances on one another does not take place without the addition of a third. Thus, for example, however water and oil may be agitated together, they do not combine; but add to them a solution of an alkali, and they combine immediately. Advantage has been taken of this principle in many of the arts; and by means of it oil actually is united with water, and forms the well-known and very useful substance—soap. Another

circumstance which we shall state here, though the Professor mentioned it later in the evening, which modifies chemical action, is voltaic electricity. Copper held in solution by an acid, is not precipitated by silver; but if the silver be placed in contact with iron in the solution, thus forming a voltaic circle, copper is precipitated on the silver. The Professor then proceeded to illustrate the two great laws of chemical action, single and double elective affinity. Thus nitric acid dissolves lime, iron, and copper; and this it does by single affinity; but it has a stronger affinity for one of these bodies than for the others, and this is elective affinity. If 100 parts of nitric acid be added to 100 parts of lime and 100 parts of copper, it does not take 50 of each, but unites with the whole of the lime, and leaves the copper untouched. In consequence of single elective affinity, the Chemist is enabled to produce single decomposition. Lime precipitates copper from nitric acid by combining with the latter. But in double elective affinity, two compounds are decomposed, and two others formed. If sulphat of iron, a compound of sulphuric acid and iron, be added to nitrat of lime, a compound of nitric acid and lime, the lime separates from the nitric acid and combines with the sulphuric acid, while the nitric acid and iron form nitrat of iron. This principle of double decomposition is not a matter of scientific curiosity merely; it is of essential use in the arts. By mixing sulphat of iron and tincture of nut-galls, the calico-printer forms his black-dye; and by a similar operation ink is made. Acetat of alumina is employed by calico-printers; but acetic acid, or vinegar and alumina, cannot be made to combine directly. Alum, however, is sulphat of alumina; and a solution of this, added to acetat of lead, precipitates a sulphat of lead, while the acetat of alumina remains in solution. This is what the calico-printers want, and this process is what they actually perform. Mr. Phillips illustrated all these principles by numerous and plain experiments; so that, we believe, not one person could fail in comprehending his meaning. At the conclusion, he announced his intention to touch briefly, in his ensuing lecture, on the doctrine of definite proportion, and on the atomic theory. To the former we have no objection: it can be made palpable without adopting the latter; and we would, therefore, entreat him to reflect before he involves us too deeply among imperceptible atoms. However he may adopt the prevailing opinions on this subject, we are quite sure he is a person of too good sense to make theories of this nature a prominent feature in lectures for Mechanics. On the contrary, he shows a disposition to teach them those principles which are applicable to the purposes of life; and one fact which they can turn to account, is of more value to them than all the theories of Mr. Dalton and Berzelius.

At the close of the Lecture, Dr. Birkbeck announced, that Sir F. Burdett had given the Institution 100 guineas; and the Society of Arts had presented it with a complete copy of their Transactions. We are extremely happy to see the Institution thus increasing in wealth, as it goes on increasing the stock of information.

PROGRESS OF SOCIETY.

During the Lecture at the Mechanics' Institution, on Friday se'nnight, Dr. Birkbeck told the following anecdote. He was discoursing of the elasticity of the atmosphere, and showing that by its pressure on the surface of fluids, they would rise only to a certain height. The principle by which this fact was explained was unknown to Galileo. The pump-makers of Florence applied to him to know why the water would not rise higher than thirty-three feet, when the Grand Duke had commanded them to raise it upwards of sixty. Galileo believing that fluids only rose, at any time, on the principle of nature, abhorring a vacuum, answered that her abhor-

rence only extended to the height of thirty-three feet. When Dr. Birkbeck told this story, there was a general laugh among the artisans present, which showed that they comprehended all the absurdity of the philosopher's answer. Thus, then, we see, and the sight is most cheering, that the workmen of the British metropolis are more correct in their knowledge, and possess profounder ideas than the Florentine Sage, even in his own favourite pursuit; and to Galileo cannot be denied the praise of having been one of the most profound men, and one of the greatest discoverers of his age.

NATIVE GOLD. MURIATIC AND SULPHURIC ACID IN A RIVER.

M. Humboldt has informed the Academy of Sciences at Paris, that he has received information from Messrs. Boussingault and Rivero, two enterprising travellers in South America, of a large mass of native gold having been lately found near Antioguia, in the Republic of Colombia, weighing eight *arrobas*, or above 190lbs. The same gentlemen have detected sulphuric and muriatic acid in the waters of a little river, which falls from a volcano, called *Puracé*, near Popayan, and which is named by the inhabitants *Vinegar* River. They also say schools for instructing miners are about to be established in that country; and already there are lithographic and other establishments, which show it to be in an improving state.

MAGNETIC INTENSITY.

Mr. G. Harvey, M.G.S. &c., has found, by Coulombe's apparatus, that a box chronometer exhibited singular proofs of strong and active magnetism. It contained a remarkable quantity of steel, and every part of it exhibited vigorous polarity. Every screw displayed its influence, and the frame alone contained ten large and several small screws; and the same intense and active magnetic power was exhibited by the chain, the axles of the wheels and pinions, the arbor of the fusee, and the balance of its springs. Mr. Cox, the agent for Arnold's chronometer at Plymouth, remarked, when he saw this chronometer, that it appeared nothing less than a *magazine of magnets*. Mr. Scoresby recommends platina, or an alloy of platina, for the balance of chronometers. Gold is said to be considered as well adapted for the balance-spring.

TO CORRESPONDENTS.

*W. L**y's communication has been received, and will appear in our next.*

Gas will see that his suggestion had occurred to ourselves. There are so many persons about town who supply chemical instruments, that it would be invidious in us to recommend any one. We may say, however, that Mr. Gurney's blow-pipe is chiefly made by Mr. Banks, mathematical instrument-maker, Strand; that if Gas live east of Temple-bar, he may seek the shop of Messrs. R. and G. Knight, Foster-lane, Cheapside; if on the west side, he may employ the scientific Mr. Newman, of Lisle-street, or Mr. Elliott, 21, Great Newport-street.

We defy the threats of Azot; and are not, as he will find, so easily stifled.

Some of our Correspondents complain of our being too learned. Is this our fault, or theirs? We will readily insert, if good, their unlearned Essays.

Cheap Drunkenness, which has come to hand, will appear in our next.

Anti-Stahl is unavoidably postponed.

*** Communications (post paid) to be addressed to the Editor, at the Publishers'.

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The Chemist.

"—— Search, undismayed, the dark profound
Where nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

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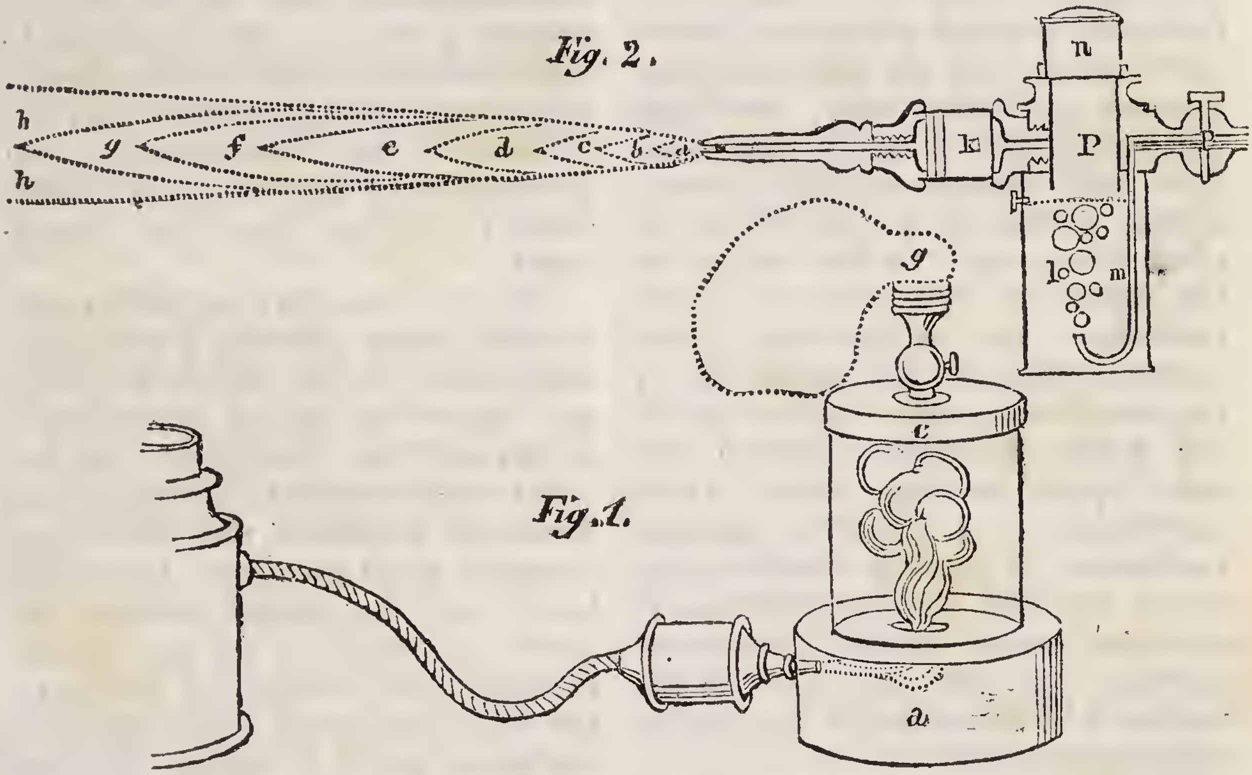

Fig. 2.

Fig. 1.

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Mr. GURNEY's INSTRUMENT FOR COLLECTING THE PRODUCTS OF DECOMPOSITION EFFECTED BY THE BLOW-PIPE.

In our last Number we gave a drawing and a description of Mr. Gurney's blow-pipe. But by this mode of operation you lose the elements of the substance you are about to examine, and are only enabled to judge of the nature of the mineral, or other body thus acted on, by certain appearances which take place during the immediate time of the operation: this also happens in using the common blow-pipe, when propelling the

flame of a lamp, at least, when those substances are operated on which it is capable of subliming. To remedy this obvious inconvenience in mineralogical research, and to enable the operator to preserve all the elements of any solid substance he wishes to examine in chemical analysis, when they are thus separated from their original state by this powerful agent, I have contrived, says Mr. Gurney, a simple apparatus, Fig. 1, and which I find from experiment to answer the purpose intended. *a* is a solid slab of plaster of Paris or of metal, with its upper surface ground perfectly true, so that, when a ground glass is placed on it, it may remain air tight on the edges, similar to that on the table of an air-pump. In the centre of the surface of this plate is a little furnace, *b*, into which one of the jets belonging to the instrument is made to terminate, by perforating from the side through the solid part of the slab. Over the furnace is fitted a ground bell glass, or part of a large tube, with a cap and stop-cock affixed, *c*, and the whole made completely air tight. To the stop-cock is attached a bladder or silk bag, *g*, in the usual manner.

The method of using this appendage in connexion with the blow-pipe is this: the substance to be examined is placed into the little furnace; the jet which perforates the slab is screwed to the safety apparatus of the instrument; and after the pressure has been on the press-board, either by weight or the hand, the gas is to be inflamed at the jet by a taper, and the glass instantly inverted over the furnace; the intense heat of the blow-pipe will now fall on the mineral, and the whole of the volatile or gaseous parts will rise, and either be condensed on the inside of the glass, or pass into the bladder through the upper stop-cock in the gaseous form; thus the whole of the elements will be retained, and may be examined by the proper tests after the action of the instrument has been discontinued. The glass may be removed by placing the slab under water, either with the safety cylinder and flexible tube attached, or by previously unscrewing it from the tablet, without any possible loss of the contents, and may be decanted into smaller vessels for more accurate examination. Any solid substance, whether a mineral or chemical body, may be analysed in the same way, and the most satisfactory results obtained.

Should the water, formed by the combustion of the oxygen or hydrogen gases, be an objection to the immediate object under analysis, a mixture of chlorine and hydrogen in the proportions to form muriatic acid may be used to produce the flame from the instrument.

Fig. 2 in the drawing is illustrative of some curious phenomena concerning flame, which Mr. Gurney observed during his experiments with the blow-pipe He noticed in his attempts to distinguish flame by pressure, that its colour changed to all the tints of the rainbow; and by giving certain degrees of pressure, he was able to produce any colour at pleasure, the tints following each other in the same order in which they are observed in the prismatic spectrum. On pursuing the inquiry which this suggested, he found that each of the rays had a different heating power, as in the prismatic spectrum; and that, as in it, there was a point beyond the rays of colour, where the heat was greater than in any part of them. On applying sufficient pressure to extinguish the flame, the wire, with which he was *testing* its power, instead of becoming, as he expected, cold, became more intensely heated, and fused into globules. At this time there was not a vestige of flame. Mr. Gurney afterwards found, by holding a bar of platina in a flame produced by the blow-pipe, it increased in its temperature as it approached nearer the jet. From this, he says, he is convinced that flame is hollow, and consists of a thin film, or coat of ignited matter.

This *coat* is composed of several layers or coats, lying one on the other: the outer coat is white, then comes red, then orange, yellow, green, blue, violet; and within the violet is an invisible coat where the combustible matter is condensed, where the chemical change between the elements takes place, and where alone the heat produced by the combustion is evolved or formed. This is fanciful enough: however, it is ingenious; and Fig. 2 is a copy of Mr. Gurney's diagram for illustrating it. *a* is the combustible gases mixed before condensation; *b* the *line* or invisible coat of actual union, or where the combustible matter is condensed; *c* the first effect of heat in producing colour, or the violet layer; *d* the green; *e* the yellow; *f* the orange; *g* the red; *h* the full combination of rays, or white, gradually losing themselves in the atmosphere. We shall not follow Mr. Gurney further in his speculations; but to us they appear more imaginative than correct.

BREAD.

(*Continued from* p. 102.)

It is the remark of a very intelligent chemist, that no set of experiments, with which he is acquainted, have been instituted and carried into effect for ascertaining what happens in the preparation of bread. As the change which the flour undergoes is, in all respects, a chemical change, this fact, which is correctly stated, is very surprising. Notwithstanding this, we remember, that the early editions of a very celebrated system of chemistry contained a detailed, if not a correct description of the whole process. We observe, that it has been omitted in later editions, which is a tacit proof that it was unworthy of public notice, and of the author's reputation. The principal experiments on bread with which we are acquainted, were made in France, a circumstance not surprising; for though other countries are called the land of cakes, that is the land of bread. Though these experiments, having been instituted as a matter of police, to ascertain what quantity of weight bread lost in the baking, are, in some respects, very correct, they are essentially incomplete as to the changes which the flour undergoes before it becomes bread. We are obliged, therefore, to begin this part of our Article by acknowledging that, on this subject, our information is neither so complete nor so accurate as we could desire it.

Bread, as our readers know, is made from flour, and more generally from wheaten flour than from any other. This is found to consist, chemically, of a small portion of mucilaginous saccharine matter, soluble in cold water, from which it may be separated by evaporation; of a great quantity of starch, which is scarcely soluble in cold water, but capable of combining with that fluid by means of heat; and of an adhesive grey substance, called gluten, insoluble in water, ardent spirit, oil, or ether, and which, in many of its properties, resembles an animal substance. The problem is, to ascertain what changes these substances undergo. When the flour is kneaded with water, it forms a tough indigestible paste, in which all these constituent substances may still be found. Heat produces a considerable change in the glutinous part of this compound, and renders it easier to chew and digest. The cake is, however, in this state heavy and tough, and is only made light by the addition of leaven, or some substance having corresponding properties, or capable of producing similar effects. If flour be mixed with a small quantity of water, and kept in a warm place, it undergoes a species of fermentation; it swells, becomes spongy, and at length acquires a sour taste, and gives out a sour smell. This is leaven. If this is left to itself, it at length begins to putrefy; mingled with other dough, it makes it rise readily, and gives it a greater degree of tenacity; the dough or paste undergoes spontaneous decomposition, the saccharine part is

converted into an ardent spirit, the mucilage tends to acidity and mouldiness, and the gluten verges towards putridity. During this process a considerable quantity of gas is produced, which is supposed to be carbonic acid gas; the dough becomes porous and increases its bulk. If this process be suffered to go on by itself, the outside and the inside are not equally affected; and it is found that some parts become mouldy before the others have acquired the proper degree of fermentation. It is found by experience, that the addition of a small quantity of leaven, and the employment of a gentle heat, accelerate the process of fermentation, which kneading makes equal throughout; and a sufficient quantity of carbonic acid gas is generated from the saccharine matter, to make the bread light before the gluten has begun to putrefy. The tenacity of the gluten prevents the escape of the gas, and the bread becomes light and porous. A certain quantity of moisture is necessary for the continuation of this process; and baking the bread, whatever other effect it may have, for this point is not exactly ascertained, evaporates the moisture so as to check the fermentation, though, unless carried to a very considerable excess, it does not wholly stop it. The very grateful smell of new baked bread, and the constant alteration which takes place in it as it grows stale, losing this smell, changing its taste, and becoming hard and dry till it moulds, are all proofs of a chemical change constantly going on in bread, though of what nature has not been distinctly ascertained. Very great care is necessary in making bread of leaven; and in general such bread does not get properly fermented, or it acquires an acid taste, from having too much leaven mingled with it, or from the fermentation being allowed to proceed too far; and it having been found that yeast answers all the purposes of leaven, it is very generally employed in most parts of Europe. In some places, however, such as on board ship, and in warm climates, where no beer is made, leaven is still generally in use. Yeast is found to make the dough rise more rapidly than leaven, and therefore makes the bread lighter.

It is obvious, that making bread is a most delicate operation, requiring definite proportions of water, flour, and yeast, or leaven; the dough, also, must be kept at a certain temperature, or, if too hot, the fermentation goes on too rapidly, and if too cold, will not go on at all: the oven, too, must be of one certain temperature, or it would not properly bake the bread. It is also to be observed, that different kinds of flour require different quantities of water, and do not all ferment alike. To regulate all these nice points, the baker has no instruments, and nothing but his experience to guide him. He trusts to his sensations: throws a little flour in his oven, and observes if it blackens or burns; plunges his hand into the water, or feels the dough; and so nice does his tact become, that what no philosopher could, perhaps, tell by the most accurate of his instruments, the journeyman baker, or the housewife, decides at once; and, perhaps, of all the batches of bread baked in this metropolis, not one out of ten thousand is spoiled. It must not, therefore, be supposed, that instruments are of no use: thermometers, to measure the heat of the bakehouse, and pyrometers, to measure the heat of ovens, have been employed with advantage. No instruments, however, can supply the want of skill and practice; and, where these are, instruments such as we have mentioned may be dispensed with.

The method of making household bread is said to be this:—To a peck of flour they add a handful of salt, a pint of yeast, and three quarts of water. The whole being kneaded in a bowl or trough, will rise in about an hour; it is afterwards moulded into loaves, and put into the oven. To make French bread, ten eggs, a pound and a

half of fresh butter, and a pint of yeast is added to half a bushel of fine flour; the whole is tempered with new milk, pretty hot, and being left for half an hour, it is made into loaves or rolls, and baked in an oven, which is not too much heated. The salt serves to make the flour retain more water, and makes the dough lighter; it makes the bread keep longer also, and corrects some of the bad qualities of spoiled wheat. The London bakers, it is asserted also, put alum into the bread, which contributes to its whiteness and lightness, but is thought to render the bread less wholesome. The quantity of this drug is increased as the flour is bad, and from four to eight ounces to a sack are used. We cannot close this Article, without recommending to such of our readers as have the opportunity, to investigate closely the chemical changes which go on in the process of bread making, analysing the dough at the different stages, for at present there is no very correct knowledge on the subject.

CHEAP DRUNKENNESS.

(*From a Correspondent.*)

MOST of your metropolitan readers, Mr. Editor, must have learned from the newspapers, that a Mr. Henry nightly amuses the audience of the Adelphi Theatre, by exhibiting people under the influence of the laughing gas. When we are every day made sensible of the fatherly care the government takes of the people, checking drunkenness, by increasing the tax on ardent spirits; removing all temptations to sin, by putting down dancing-houses, glee-clubs, fairs, and private theatricals, and encouraging holiness of life by building churches and paying parsons; keeping from the unsullied minds of the people all knowledge of evil, by stopping the circulation of books not approved of by the Vice-suppressing and Tract Societies; forbidding them to break their necks, by breaking down stage-coaches with their weight; and providing them with comfortable lodgings in houses of correction, if they are found exposing themselves to the inclemencies of the weather, I, for one, Sir, am much surprised that it should permit this exhibition by Mr. Henry; and can only account for its negligence, by supposing that it is not so learned in chemistry as it is in morality and theology, and is ignorant that what he calls the *laughing gas* is a fluid, which, at a small expense, produces a most delightful, though transient state of intoxication. The exhibitor, probably, had an eye to concealment when he called it *laughing gas;* had he called it *nitrous oxide*, the President of the Royal Society, who was the first to get excessively tipsy by inhaling this fluid, and the Poet-laureat, (Mr. Southey) who, at one period, drank largely of it, —though the influence of any rapture-inspiring drink is not very perceptible in his writings, and who has, on several occasions, loudly and energetically in sounded the tocsin, when he thought it was necessary to rouse ministers to a more than ordinary degree of vigilance in taking care of the morality of the nation,—would have both thought it their duty, *ex-officio*, to warn the government of the numerous ill effects which might result from teaching people to get drunk at a cheap rate. Perhaps, Mr. Editor, you may subject yourself to a prosecution by Mr. Murray, should you insert this communication, for spreading abroad a knowledge of a means to get easily and pleasantly fuddled, which, as all the world knows, is the forerunner of all mischief. At least, I remember an unfortunate man being most severely punished some years ago for this violation of decorum. Our seamen, it is well known, have a very strong propensity to forget all the cares of the world, including a forced absence from wives and families, and flogging in abundance for not liking this, and on board one of the King's ships, the men were perpetually in a state of intoxication. For a long time it was not possible to ascertain how this happened.

The purser was closely examined, but he was quite positive that not one of the seamen had received a drop more than his allowance; the hold and the spirit-room were carefully inspected, but not a hole was found large enough for a mouse to creep through: consequently no toper could have reached the rum casks; and if the mouth could only be kept shut after grog has been taken in, the secret might not have been discovered till this time, and the nation might have been vanquished, invaded, and destroyed, by a cheap mode of getting drunk. One of those who could neither sit nor stand, (walking was quite out of the question) betrayed the secret. After drinking his grog, he boasted that he placed himself on his head, with his heels in the air, till the liquor took full effect, and he became glorious and oblivious. Standing on the head was immediately put a stop to, and the individual who had discovered this great improvement in the arts, and great saving of labour, having been found out, he received flogging enough to keep him sober at least till he got out of the hospital. If the poor sailors had only known of Sir Humphrey Davy and Mr. Southey's mode of committing excesses, they might have enjoyed their elysium unflogged till this time; for the drunkenness which they indulged seldom goes so far as to make a man unfit for muscular exertion. Their mode was to breathe nitrous oxide, or the laughing gas of Mr. Henry. As your readers may wish to learn this mode of intoxicating themselves, to the ruin of Messrs. Hodges and Barclay, and all the fraternities of distillers and brewers, I shall now communicate this agreeable information.

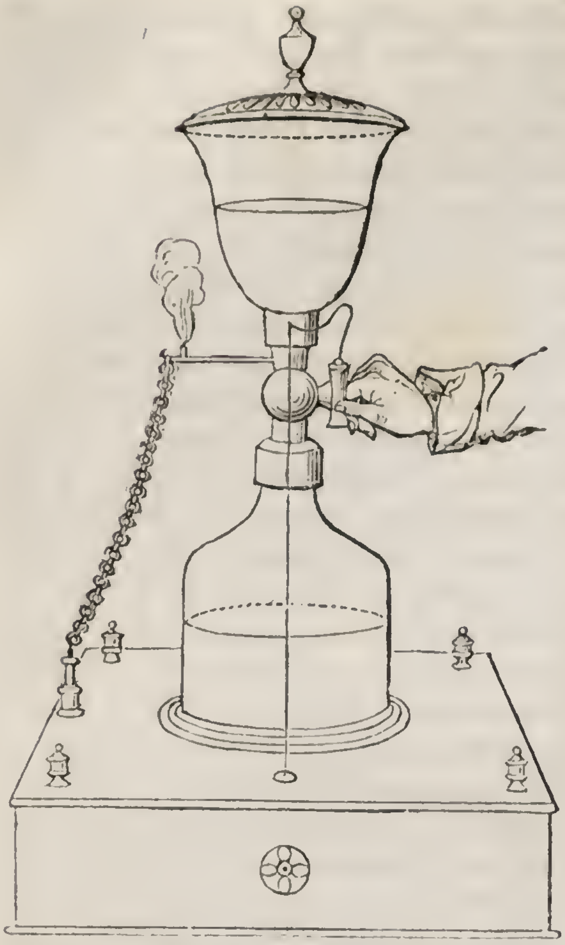
Let them, then, purchase some of the salt, known to chemists by the name of nitrat of ammonia, (I believe they may tipple for a week for the value of two-pence) put it into a glass retort, and apply to it the flame of an argand lamp. When the temperature reaches 400° of Fahrenheit, a whitish cloud will begin to project itself into the neck of the retort, accompanied by a copious evolution of gas. This gas is nitrous oxide. It should be received into a bladder, from which atmospheric air has been previously, as much as possible, excluded by mechanical means, such as twisting the bladder together, allowing the air to escape; and the bladder should have a pretty wide glass tube affixed to its mouth. A silk bag will answer as well as a bladder, but it is more expensive. A large bladder is however requisite, as it takes a few quarts of the nitrous oxide to produce a full and proper effect, and it must be inspired two or three minutes. Having thus collected the gas, which is of a sweetish taste, possessing all the mechanical properties of air, it may be easily breathed; but care must be taken not to be in a hurry, as the terror people feel sometimes prevents the gas from having its proper effect. If this gas be breathed for two or three minutes, a most agreeable intoxication is produced, which strengthens and invigorates the body as well as the mind, and leaves no lassitude or blue devils, or head-aches requiring soda-water, behind. But as your readers may not trust me, I shall transcribe for them Sir H. Davy and Mr. Southey's account, the latter being of course by far the most poetical. The former says, "Having previously closed my nostrils and exhausted my lungs, I breathed four quarts of nitrous oxide from and into a silk bag. The first feelings were those of giddiness, but in less than a minute, the respiration being continued, they diminished gradually, and were succeeded by a sensation, analagous to gentle pressure on all the muscles, attended by a *highly pleasurable thrilling*, particularly in the chest and the extremities. The objects around me became dazzling, and my hearing more acute. Towards the last inspiration the thrilling increased, the sense of muscular power became greater, and, at last, an irresistible propensity to action was indulged in. I recollect but indistinctly

what followed. I know that my motions were various and violent. These effects very soon ceased after respiration. In ten minutes I had recovered my natural state of mind." Mr. Southey felt first a fulness and dizziness in the head, such as to induce a fear of falling. This was succeeded by a laugh, which was involuntary, *but highly* pleasurable, accompanied with a peculiar thrilling in the extremities, *a sensation perfectly new and delightful.* For many hours he imagined that his taste and smell were more active, and certainly felt unusually strong and cheerful. In a second experiment he felt pleasure still superior; and once poetically remarked, that he supposed the atmosphere of the highest of all possible heavens to be composed of this gas. Mr. Wedgewood, after breathing this gas, threw the bag from him, and kept breathing on laboriously with an open mouth, holding his nose with his left hand, without power to take it away, though aware of the ludicrousness of his situation. All his muscles seemed to be thrown into vibrating motions; he had a violent inclination to make antic gestures, seemed lighter than the atmosphere, and as if about to mount. Before the experiment he was a good deal fatigued by a long ride; but after the experiment every trace of fatigue had vanished. In a second and third experiments, the same effects were perceived, only that the pleasure was in the third much greater than in the two others. Indeed, Sir H. Davy, who has fuddled himself pretty often with this gas, declares that it is far better than champagne, as it not only gives a more intense pleasure, but leaves no head-ache, and does not diminish in its effects from repeated use. Mr. J. W. Tobin said, his sensations were exquisite, quite indescribable; and that he felt his strength permanently increased by it. Here then, Sir, is abundant testimony to the superiority of this as an inebriating fluid. The advantages for the public will be as great as for the individuals. There will be no occasion to import French wines or Dutch gin; the corn which is now consumed to make beer, and the sugar which is converted into rum, may both be employed to nourish an increased number of people; and the world may bid defiance to Mr. Malthu and his gloomy doctrines, as long as it has such resources in store as the immense tracts of land now every where employed in producing the materials for making strong drink. I understand, Sir, if the government shows no inclination to check this manufacture by a heavy stamp duty, and while the present liberal notions as to freedom of trade prevail in the cabinet this is not expected, there are to be two or three manufactories of this gas established in different places. The individuals will not, however, be required to go through the terrific process of applying their mouths to bags or bladders, but will just pass through an elegant room, constructed on the gasometer principle, the doors of which are to be valves. I shall not enter further into details, but only remark, that though signs, as in former times, may be necessary to point out the spots where men may get cheaply drunk, it will not be necessary to add "clean straw provided;" for this is so pleasant a mode of losing one's senses, that a stage may be necessary for the exhibition of the merry-andrew tricks of the inspired; but no sleeping apartments will be requisite.

I am, Sir,
Yours obediently,
ANTI-DRAM.

TANNIN IN CHESNUT-TREE BARK.

It is announced in a German journal, that the bark of the chesnut-tree (*Castanea vesca* of Wildenow, *Fagus castanea*, Linn.) contains twice as much tannin as that of the oak, and gives with sulphat of iron a very fine black ink. The colour furnished by the tan of chesnut bark is less susceptible of change, by the influence of the sun and rain, than that which is given by sumac.



HYDROGEN GAS LAMPS.

At a time when there is a good deal said about these lamps, we must acknowledge our obligation to the intelligent Correspondent who has directed our attention to the one here described; though not having the book he mentions on our own shelves, and, in fact, never having seen it, we can do no more than insert his communication.

To the Editor of the Chemist.

Sir,—In the *Philosophical Magazine* for last October, (No. 306) page 283, it is represented, that the hydrogen gas lamp, improved by M. Gay-Lussac, is very convenient for making Mr. Dobereiner's experiment; that is, of directing a stream or jet of hydrogen gas upon a piece of spongy platinum, so as to ignite the metal. Now, as this kind of apparatus is more simple, instantaneous, and effectual than the one of Mr. Phillips's, described in your laudable Chemist, No. III. page 33, myself, and no doubt others, your readers, would be obliged to any of your correspondents for a figure and description of this improved lamp of M. Gay-Lussac's.

An elegant and perfect hydrogen gas lamp, acting by the electric spark from an electrophorous, after Volta's principle, was some years ago constructed by Mr. William Jones, of Holborn, the eminent optician, which he published a figure of, in his edition of Adams's Lectures, vol. 5, plate 7, fig. 6, a sketch of which I add; but the addition of a zinc cylinder, and possibly other differences, by Gay-Lussac, may have farther improved this very curious instrument.

A Constant Reader.

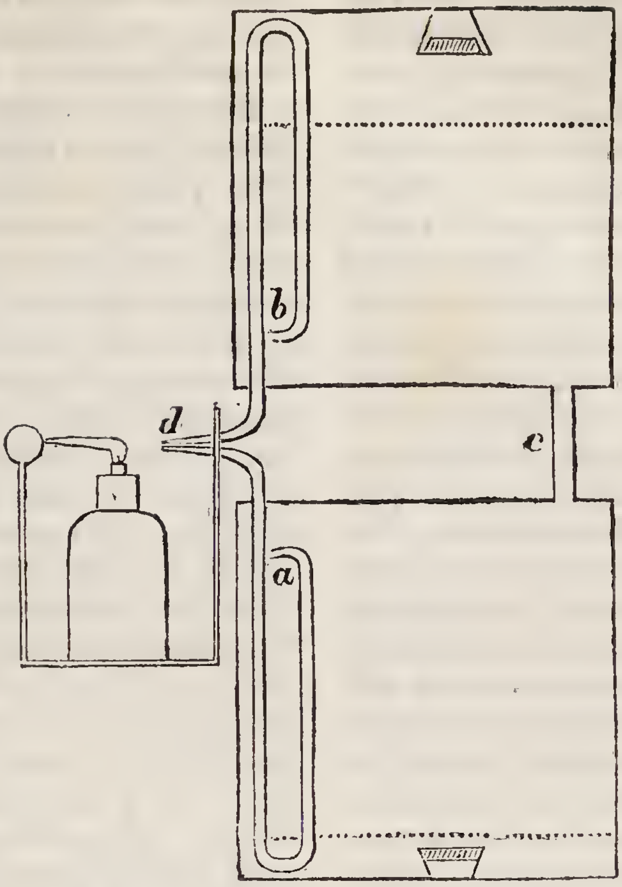
TO MAKE CHALYBEATE WATER.

If a few pieces of silver be placed alternately with pieces of sheet iron, so as to form a small pile, and be immersed in water, the fluid soon acquires the taste of iron, and becomes of a yellowish hue. In 24 hours flakes of oxide of iron appear. By replenishing the vessel, in which such a pile is placed, with water after every draught, we may have a very good substitute for a perpetual chalybeate spring. Clean copper plates would answer instead of silver, or a clean copper wire entwined on an iron rod; but this is rather dangerous, and silver should be preferred.—*Phil. Mag.*

EFFECTS OF ATMOSPHERIC PRESSURE ON THE RATES OF CHRONOMETERS.

(*From the Annals of Philosophy.*)

Mr. Harvey, F.R.S.E., has lately discovered, that the density of the medium in which a chronometer is placed, has a sensible influence on its rate, in most cases producing an acceleration when the density is diminished, and a retardation when the density is increased. A difference of density denoted by an inch of quicksilver is sufficient to produce in many chronometers a visible alteration of the rate. Mr. H. therefore concludes, that a chronometer constructed at London, nearly on a level with the sea, would undergo an alteration of rate from difference of atmospheric pressure, if transported to Geneva or Mexico, or any other place much above the level of the sea.



To the Editor of the Chemist.

SIR,—Observing in your last an account of three different blow-pipes, I herewith transmit you a plan for a self-acting perpetual one, which might be of great use in some operations in mineralogy, where a continued blast is required, since, unlike the spirit blow-pipe, it is worked free of any expense whatever.

The figure is intended to represent a section of two cubical vessels, together with tubes bent in the shape there represented, open at the ends, *a b*, and tapering to fine jets at *d*. These two vessels are connected together by the tube, *c*, and are each furnished with a valve, opening inwards, as in the sketch.

If now the upper vessel be nearly filled with mercury, (water will do if the machine be large, but if small mercury must be used), as represented in the figure, the mercury, by its descent into the lower vessel, will force the air from thence through the aperture, *a*, and out at the jet, *d*, and will there furnish a continued blast of air, until the mercury has descended from the upper vessel into the lower one, when, by reversing the apparatus, as an hour-glass, the operation will be repeated as before, forcing a stream of air out at the jet, *d*. The apparatus, *e*, (containing a spirit-lamp and platina forceps or needle, on which the mineral or substance to be acted on is to be placed), is made to revolve on an axis at *d*, so as always to keep the lamp in a perpendicular position. It will readily be perceived, that if the tubes be not bent in the shape represented in the sketch, the mercury, by getting into them, would stop the action of the blow-pipe. Should this simple invention be considered as worthy of publication, it is quite at your service.

I am, Sir,

Yours, &c.

W. L**Y.

ANALYSIS OF SCIENTIFIC JOURNALS.

(*Continued from* p. 85.)

ANNALS OF PHILOSOPHY FOR MAY.

WE wish we could say that the information contained in the expensive quarterly and monthly Scientific Journals was commensurate to the cost; or, that their Editors were at pains to make them the worthy representatives of the

increasing knowledge of the age. These Journals being conducted on the principle of gratuitous contribution, depending for their existence on the chance discoveries of the month or quarter in which they are concocted; and rarely having, besides the editor, any literary persons regularly employed either to collect or contribute articles, are sometimes replete with good matter, and sometimes do not contain a thing worth transcribing. The latter is the case with the present Number of the Annals. Nor can we imagine an excuse for this. At first sight, indeed, science appears so unlike literature, it may be supposed, unless some new discoveries are made within the period which elapses between the days of publication, that it is impossible for these Journals to have any thing new. They cannot make facts, and they dare not unsettle established theories. But are there no parts of the field of science not yet laid out, and not yet properly prepared for cultivation? We believe there are many; and persons who can obtain nothing by writing books on such subjects, might be conveniently retained to prepare Essays for these Journals, which, under the pretext of giving us novelties, make heavy demands on our pockets. The Quarterly Journal of Science does apparently hire the services of one or two caustic reviewers. We observe that a new Journal of this description is to be started in Edinburgh, in which several gentlemen are to be engaged; but the greater part of our Scientific Annals seem to depend wholly on chance for their articles, and to take little pains to collect what is new, and no pains to make what is old better known by putting it in a more agreeable dress, or in a more elegant form. Rivalries, however, are starting up all around, and one great advantage which we are quite sure will result from our publication, and others of the same kind, is, that the older and more expensive ones will soon be much improved. By the following analysis of the ANNALS our readers will be able to decide whether or not improvement be needed.

The first article, Remarks on Solar Light and Heat, by Baden Powel, M.A., consists, first, of a brief review of the present state of our knowledge on the subject, with a view to forming a sort of introduction to some experimental researches on solar light and heat, which Mr. Powel has already laid before the Royal Society. In this brief view we are told that it was supposed the sun sends out two emanations, one of light and another distinct from it—"Though a confused idea of some very close and intimate connexion subsisting between the solar light and heat appears to have prevailed." We are then reminded that Boyle, Franklin, Scheele, Leslie, and Sir H. Davy have made experiments, and have "established the property of the emanation derived from the sun, of producing greater heat in bodies, in proportion as their surfaces, owing to the darkness of colour, have the capacity of absorbing rays of light." It has been equally established by Professor Leslie, Count Rumford, and others, that "the heat emanating from a mass of non-luminous hot matter, has no such relation to the colour, though it has a very close one to the nature and texture of the surface." Then we are reminded that "philosophers have entertained very different opinions as to the nature of this heating effect: one party maintaining the totally distinct existence of light and radiant heat in the compound solar beam; the other contending for the absolute identity of the two." Mr. Powel does not discuss the merits of either opinion, but proceeds to state some of the properties of the solar rays, that they may be compared with other heating emanations. "One of the most obvious of these is, that they produce heat in bodies in proportion to the darkness of their colour," &c. "Heating emanations from terrestrial bodies, whether luminous or not, are more or less stopped, or even

in some cases *totally intercepted* by the interposition of a glass screen." Mr. Powel then details some experiments he made by intercepting the solar light with a glass screen, from which, he thinks, " we are entitled to conclude," that " the whole emanation consists of one sort of rays distinguished by the two characteristics of affecting substances with heat, in proportion to the darkness of their colour, and being *wholly* transmissible through glass without heating it"—" This heating effect increasing and decreasing, in proportion to the intensity of illumination." Mr. P. further concludes, that the heat of the solar rays exists in a state different from that of simple radiant heat. He therefore says, " instead of using such terms as '*calorific rays*,' and '*luminous rays*,' that it would be better to use the terms, 'rays of light, and the heating power or property of these rays.' " Some remarks are then made to show that in the modifications made in these rays by transmitting them through prisms, &c. the direct rays are not accompanied by any separate heating rays, which are either stopped by glass, or bear a relation to texture more than colour. Finally, Mr. Powel tells us, that his object in making these remarks is merely to attain, if possible, some clear ideas on the subject, and to point out those parts of it which appear to him to want further elucidation. Now, surely we may ask Mr. Powel and the learned Editor, if it would not have been sufficient for this purpose if the former had thought over these matters himself, without communicating his *non*-clear ideas to the public. We thank him for directing notice to points which want further elucidation. To us it appears from the whole tenor of the paper, that this gentleman wishes to inculcate the opinion of the heat and light in the solar ray being identical. Now, we must observe that the sun's rays exciting vision in us, or expanding mercury in the thermometer, is not the production of the sensation of heat. Mr. Powel will not get to the bottom of this matter by the " definite criteria" of which he so learnedly speaks, as long as he confounds sensations of vision and sensations of heat. The sun is no sooner rolled above the horizon than the day comes in all its glory; but the earth must roll on for some hours before the heating effects of the sun are perceived. The first step in all such inquiries is certainly to get, which Mr. P. says he wants, clear ideas of the subject to be inquired into; and we can tell him that he will never get these, unless he constantly distinguishes between the power of the sun to expand certain substances, its power to produce sensations of sight, and its power to produce sensations of heat. We never see heat, and we never feel light; nor when we see one, or feel the other, is the second always perceived. It may be that these different effects are produced by the same ultimate cause; but they are so distinct from one another, take place at such different times, and under such different circumstances, that their immediate causes must be different, and these immediate causes are rational objects of inquiry. The fact which this paper is written to prove, and it is meant to be very profound, and which the experiments were established to elucidate, is, that *a pane of glass does not intercept the heat of the solar ray.* This may be science, but it is not wisdom.

Art. II. Contains a few astronomical observations; and, Art. III. is a long account, by a very learned Swede, of the reduction of some metallic sulphats, by means of hydrogen gas. In Art. IV. we have an analysis of some minerals by the same gentleman, in which we observe nothing of importance, but it is valuable as serving to prove what has long been known, we believe, that little confidence can be placed in the analysis of the secondary compound bodies, as Mr. Arfwedson's analyses differ from those of other celebrated Chemists. In Art. V. we find a Mr. Herapath taking up

three or four pages of the Annals, with an explanation of the principles of his theory of evaporation, which some people seem to have misunderstood, in spite of his hints, and giving some additions, to make it more valuable. He is at some pains to state a law, which has no relation to the fact of evaporation, and which, he confesses, is not mathematically true; and, suiting neither, may be considered as useless. There follows, in Art. VI. an analysis of Analcine, by Mr. Rose, taken from the *Annales de Chimie et de Physique*, in which Mr. Rose states, he is at a loss to account for the difference between his analysis and that of M. Vauquelin, furnishing another proof of the uncertainty of such researches. We highly approve of one part of the proceedings of the author of Art. VII., who thinks an arc may be trisected by the right line and circle, by some *of the principles* he offers to public notice; though he is obliged to dismiss the subject from his mind, which is the part of his proceeding we most approve of, and shall immediately follow so laudable an example. Those, however, who are not satisfied as to the squaring of the circle, may undoubtedly read Mr. Walker's paper with interest. Mr. H. I. Brooke gives, in Art. VIII., an account of the crystalline forms of Perchloride of Carbon. In Art. IX. Professor Cumming gives the following account of his Plan for obtaining instantaneous Light. Having removed the electrical apparatus from a Volta's lamp, I placed a fragment of precipitated platina between two pieces of a watch-spring, which are inserted into a cork, fitting into a small bent tube, as a cap. The distance of the platina from the jet is about three quarters of an inch, and a small wax taper is fixed about half an inch beyond the platina. The only precautions I have found necessary, are to replace the cap immediately after each experiment, and to employ a pressure upon the hydrogen of not less than five or six inches of water. The remaining articles are an account of a new Mineral, and some controversy between a Mr. Henslow and a Dr. Berger, as to the geology of the Isle of Man. The Number closes with an analysis of new books, and some notices of Scientific Societies. This is meagre fare for so celebrated a publication as "The Annals;" and we at least are quite disinterested when we warn the Editor, that more exertion will be requisite, if he means to maintain the ground he has acquired.

CHEMISTRY AS A SCIENCE.

Art. IX.

BORON. SULPHUR.

We ought to have placed the first of these two substances in our last Number, along with Carbon, as it has more resemblance to that substance than to sulphur; but we thought the article sufficiently lengthy, and therefore postponed it. Indeed, so little is known of boron, that it seems almost ridiculous to class it with the elementary matters of the globe; and we only do it in compliance with the opinions entertained and promulgated by the most celebrated chemists. However, it has not yet been decomposed, which is a sufficient reason for the classification.

Boron is obtained from that substance called borax, which, though a foreign production, is well known in our country, having been used for a long period to promote the fusion of metals, and having long been employed in medicine. Borax is said to be dug out of the earth in Thibet, and the principal part of it consumed in Europe comes from the East Indies. It is also said to be found in Saxony, and in some mines in South America, where the natives employ it to promote the fusion of copper ores. This substance has been reduced by chemists into a peculiar acid, called *boracic* acid, and soda, one of the alkalies.—Messrs. Gay-Lussac, and Thenard, succeeded, in 1808, and Sir H. Davy, in 1809, in decomposing this acid, showing that it was a compound of oxygen, and a peculiar substance, to which they gave the

name of boron. It is obtained by heating potassium, a metal to be hereafter described, in contact with boracic acid, previously reduced to powder. The metal takes the oxygen from the acid, and leaves the boron in a separate state. It is a powder of an olive brown colour, without either taste or smell. If excluded from the air, the most intense heat has no other effect on it than to increase its density; but when exposed to the action of the air, or of oxygen gas, and heated to the temperature of 600°, it burns with great splendour, combining with oxygen, and forming boracic acid. It is insoluble in water, alcohol, ether, and oil. It has never been found native, in an uncombined state, but in combination with magnesia and lime it exists in various parts of the world. The small quantity of it which has ever been obtained pure by the art of the chemist, has been put to no practical use; and at present, therefore, it is a mere object of scientific curiosity.

Sulphur, called also brimstone, is the second undecompounded substance we have yet mentioned which was known to the ancients, but most certainly not thought by them worthy of the place now assigned it among the elements of the globe. Pliny mentions, that it was used as a medicine, and wool was bleached by its fumes. Considerable quantities of sulphur are found pure in those mountains which geological writers call secondary, and in the neighbourhood of volcanoes. In Spain, near Cape Trafalgar; and in Arragon, in various parts of Sicily and Italy, in Hanover, and in several other parts of the world, sulphur is found very abundantly. Combined with metals, principally with iron, it forms those substances called pyrites, glance, and blende; and is met with in some one or other of these combinations in most of the primitive mountains, and in most of the countries in the world which are rich in metallic ores. We find it in the shops in two states, one in which it is called flowers of sulphur, and the other roll sulphur. The latter is very impure, but the former is tolerably free from impurities. As it is found native, or after being melted and congealed, it is a hard, brittle substance, of a yellowish green colour, without any smell, and having a weak but perceptible taste. Its specific gravity is 1.990, or it is nearly twice as heavy as water. The air has no effect on it at low temperatures, and it is insoluble in water. It melts at about 220° Fahrenheit, or at a heat somewhat greater than that of boiling water; and at a still lower temperature, or about 170, portions of it rise up in the form of a fine powder, which may be easily collected in proper vessels. This powder is what is mentioned above as flowers of sulphur; and substances which rise up in this manner, on the application of a moderate heat, are called volatile, the process being called volatilization. When a sufficient heat is applied to it to make it boil, it is converted into a brown coloured vapour; and if the experiment be made in a vessel with a narrow mouth, the vapour issues from it with considerable force. At a temperature of 560° Fahrenheit, it takes fire in the open air, and burns with a pale blue flame, emitting fumes of a very strong suffocating odour. If burnt in oxygen gas, with a sufficient heat, the flame is violet coloured, the fumes are very thick, and the whole of the sulphur is consumed. If the product of this combustion is collected—and combustion is not, as is sometimes vulgarly supposed, the destruction of any portion of matter, but only a change in its form—it is found to be the substance known by the name of sulphurous acid. By the combustion of sulphur, then, an acid is formed; and it has been shown by Lavoisier and others, that during the combustion the sulphur unites with the oxygen of the air, and that the acid formed is exactly equal in weight to the sulphur and oxygen which disappear. Hence he concluded, that the acid was a compound of these two

bodies, an opinion which is now generally adopted. This is worthy of the reader's attention, because it is one of those facts on which successive theories of chemistry have been founded, and to which, in our account of these theories, we shall have occasion hereafter to advert.

If a roll of sulphur be exposed to a sudden, though gentle heat—holding it in the warm hand, for example—it cracks, and sometimes falls in pieces. If it be melted, and when the surface begins to harden, the remainder of the fluid be drawn off below, the inner part of the hardened surface will be found in the state of long, needle-like crystals. Alcohol, ether, and oil, dissolve a small quantity of sulphur.

Sulphur is of great importance in chemistry, and in the arts. It is employed in large quantities in making gunpowder, and it is administered as a medicine. It checks the fermentation, of wines and other liquors, and is employed for this purpose. If kept melted in an open vessel for some time, at about 300°, it becomes thick and viscid; and if it be then poured into a basin of water, it is of a red colour, and is ductile like wax; its specific gravity is increased; and as this change takes place in close vessels, it has been thought an argument for the compound nature of sulphur. In this state, sulphur is used for taking impressions of seals and medals. Sulphur is employed in several other modes, but it is when combined with oxygen, so as to form sulphuric acid, or oil of vitriol, that it is of most use in chemistry, and is chiefly employed in the arts. Without in this place describing the properties of sulphuric acid, we shall merely notice at present the principles of its formation.

If the sulphuric acid above mentioned, as the result of burning sulphur in oxygen gas, be exposed to the air, it gradually loses its sulphureous smell, and becomes more fixed. Much of the water which it still retains may be got rid of by the application of heat, and the dense acid which remains is sulphuric acid, or oil of vitriol.—The mode in which this important acid is manufactured on a large scale, we shall hereafter describe; we only mean at present to add, that sulphuric acid contains one-third more oxygen than sulphurous acid, and owes to this its more active properties.

ANT-HILLS IN NORWAY.

The country round Drontheim, says Mr. Brooke, in his Travels to the North Cape, presents nothing like the appearance of forest; but the thick copses and tangled thickets on the borders of these lakes, and the beautiful luxuriancy of the vegetation, made amends for the absence of the deeper shade of the pine. In some parts an almost insuperable barrier presented itself to our steps, in the matted branches of the dwarf shrubs, interwoven with various kinds of creepers. Sometimes an enormous ant-hill interposed itself, nearly the height of a man, and almost approaching in size and appearance to the *gamme*, or hut of the coast Laplander. Nothing can be more curious than these really gigantic habitations, raised by so diminutive an animal. A close inspection shows, that they are composed principally of small particles of bark and decayed wood, intermixed with light soil. The approach to them, like that of a populous city, was through a spacious road, more than a foot in width, along which millions of these little negroes were hastening heavily loaded, while others were setting out on their different expeditions. From the principal street innumerable little alleys and avenues branched out, which might be called the suburbs of this republic, all equally crowded with the black swarm, pressing forward with signs of the greatest haste and diligence. These ant-hills, which in the northern forests cannot fail to attract the attention of the stranger, are the work of a large species of black ant.

TEMPERATURE AT WHICH OIL EMITS AN INFLAMMABLE GAS.

To the Editor of the Chemist.

Sir,—Will you allow me, through the medium of your intelligent and amusing Publication, to ask, whethe the difference of opinion, which caused such an acrimonious controversy between two scientific gentlemen some months since, has yet been decided. I have myself anxiously looked for it, but in vain. I mean as to the temperature at which oil emits an inflammable gas. I regretted exceedingly the warmth of expression with which each of the disputants supported his opinion; and considering the professional character of both pledged as to the issue, I am astonished that they should mutually have contented themselves with recriminatory abuse and invective, on a subject, the proof of which is as easy as the difference is palpable. I need not inform you, I allude to the evidence as given in the trial of the action, "Severn, King, and Co. *versus* the Imperial Fire-office."

Your friend,

Anti-Stahl.

We believe the question has not been fully set at rest; but we understand that another trial is shortly to take place, when it most probably will be.—Ed.

LITHOGRAPHY.

As soap forms an essential part of the ink used to trace the designs on stone, it is customary to wash the drawings, before going to press, with a weak solution of nitric acid, which, combining with the excess of alkali in the soap, renders the ink insoluble. But the acid solution sometimes attacks also the carbonates, which are a constituent part of the lithographic stones, and the most delicate parts of the drawings are destroyed. This is more particularly the case when the drawings consist of strong and delicate traits, or of a great difference in the intensity of their light and shade, in consequence of the different periods, or of stronger or weaker acids, which are then necessary to decompose the lithographic tints in the different parts of the drawing. To remedy this, M. Ridoffi employs nitrat of lime, perfectly neutral, in lieu of the acid solution, which decomposes the soap without injuring the stone. The nitrat is made by adding to the aquafortis of the shops pieces of the lithographic stones reduced to powder, as long as any effervescence arises; it is then weakened by adding rain-water, is filtered, and preserved for use.—*Bulletin des Sciences Technologiques.*

TEST FOR GUM.

To the Editor of the Chemist.

Sir,—If you, or any of the readers of your instructive little work, can inform me of a convenient test for gum, when in solution, it will greatly oblige,

Your obedient servant,

Woolwich, May 3. Alwin.

P.S. I am aware that it may be detected by evaporating the menstruum in which it is held; but a test to ascertain its presence and quantity, without that trouble and time, would be of great service to me, and perhaps many more of your readers.

In answer to this question, we must observe, that silica is a very delicate test for gum. Silicated potash, added to a solution of gum, forms, with the gum, a white, flaky, and insoluble precipitate. A precipitate is formed, although the solution be very weak; the liquid remains transparent. Perhaps some of our readers may suggest a better test. We know of none.—Ed.

COMBUSTION OF IRON IN VAPOUR OF SULPHUR.

If a gun-barrel, says Professor Hare, be heated red-hot at the butt end, and a piece of sulphur be thrown into it, on closing the mouth with a cork, or blowing into it, a jet of ignited sulphurous vapour will proceed from the touch-hole. Exposed to this, a bunch of iron wire will burn as if ignited in oxygen gas, and will fall down in the form of fused globules, in the state of protosulphuret. Hydrate of potash, exposed to the jet, fuses into a sulphuret of a fine red colour.—*Phil. Mag.*

VINEGAR MANUFACTURED FROM ANTS.

There is a peculiar acid obtained from ants, called the formic acid. This is one of the modern discoveries of chemistry; and it is curious enough, says Mr. Brooke, that a discovery of modern chemistry should long have been practically employed in some parts of Norway to make vinegar. The method they employ in Nordlanden is simply this:—They first catch a sufficient quantity of these little animals by plunging a bottle partly filled with water up to the neck in one of these large ant-hills, into which they naturally creep, and are drowned. The contents are then boiled together; and the acid thus produced being strong and good, is made use of by the inhabitants as vinegar.

THE QUARTERLY JOURNAL OF SCIENCE *versus* MR. IVORY.

We take some little credit to ourselves for having been, we believe, the first to expose the want of good faith and candour which is so plainly perceptible in the criticisms of the "Quarterly Journal of Science." We see by the Philosophical Magazine, that Mr. James Ivory, a very celebrated mathematician, also complains of the burlesque comparisons of the "Quarterly Journal." Burlesque on tables of refraction! After this, we shall expect to see the Elements of Euclid turned into ridicule in the Journal; and then, probably, the friends of the learned writer may begin to think of placing him in safety.

TO CORRESPONDENTS.

The communications of a Chemist have been received. We are sorry that circumstances put it quite out of our power to comply with the request contained in the first part of the note of F. Smith. *In reply to the other part, we have to observe, that magnesia being only partially soluble in water, no definite proportion of these two ingredients can well be given; and he must have remarked, it is stated, that the magnesia is kept* SUSPENDED, *not dissolved, in the water, by constant stirring. About* 1*lb. of manganese is employed for* 10 *gallons of the water, in which as much magnesia has been put as it will dissolve, and such a quantity more as will give the water, when agitated, a milky appearance. The proportion of the muriatic acid to the manganese is stated in* No. VI.

J. W., of Stockport, is informed, that the charge which he mentions is enormous, considering the value of both materials; but we cannot tell, in the individual case he mentions, whether it was a fair remuneration or not. If he turns to our No. V. p. 75, *he will find a description of the mode of making oxymuriate, or chlorate, as it is now called, of lime. This substance is prepared on a large scale, for various purposes in the arts; and in transcribing the article relative to its employment as a manure, we had an eye to the waste chlorate being so used. We shall attend to our Correspondent's other suggestion, and shall be happy to learn from him the result of his own experiments.*

The second communication of a Chemist has come to hand, but so late that it was not possible to insert it in the present Number. We do not think we shall even be able to find a place for it in the next; and, agreeable to his request, therefore, it is left at our publisher's.

A. B. shall appear in our next.

*** Communications (post-paid) to be addressed to the Editor, at the Publishers'.

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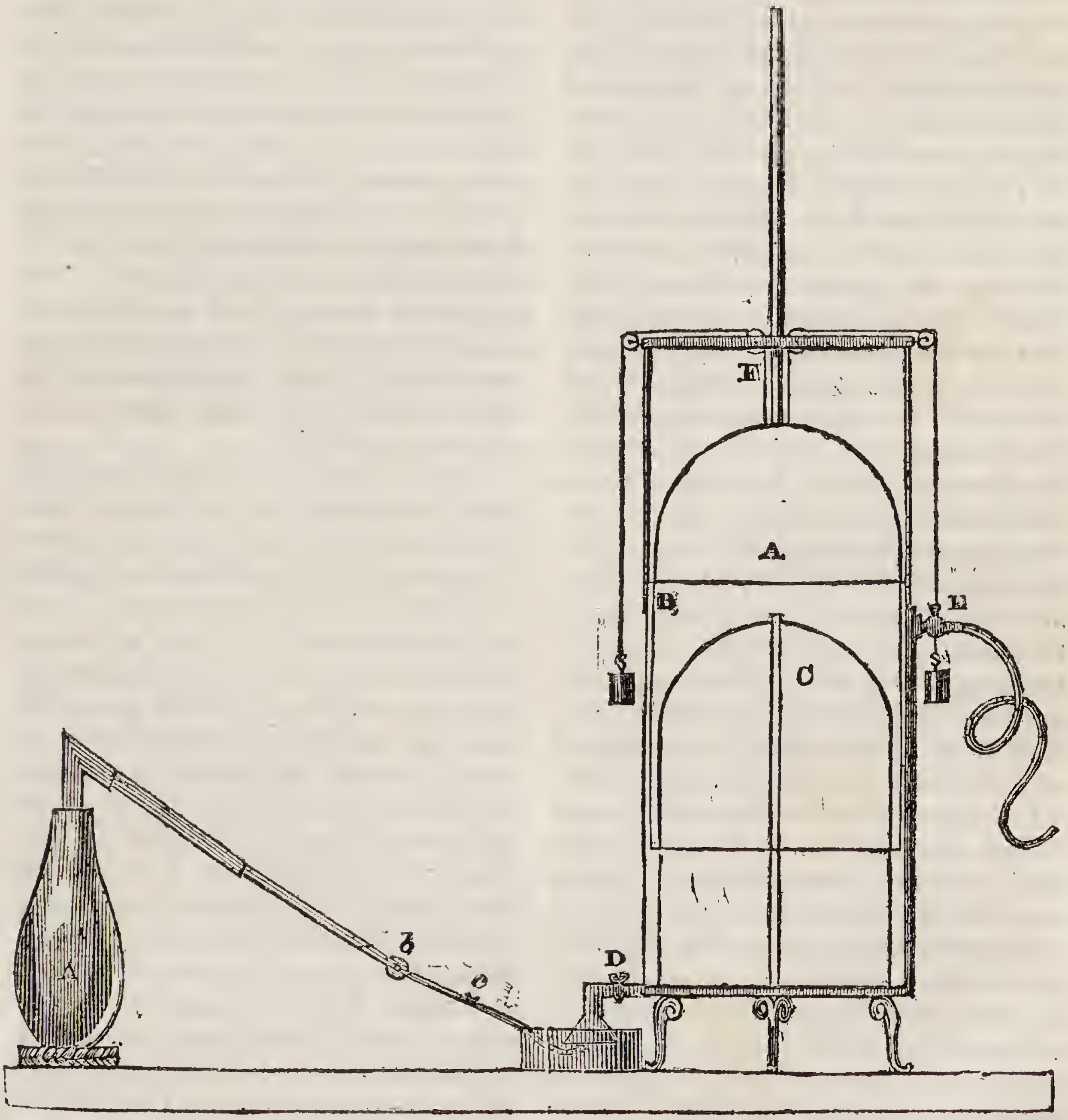
The Chemist.

" —— Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. X.] SATURDAY, MAY 15, 1824. [Price 3*d*.



CONTENTS.

CHEMICAL APPARATUS.

GASOMETERS.

One of the principal instruments necessary for operating on the gases is a gasometer; and one of the most simple forms of this instrument is that represented in our plate. It is made of tinned iron, the surfaces of which are japanned, and consists of two principal parts; a vessel, A, somewhat bell-shaped, which is designed to contain the gas, and a cylindrical vessel of rather greater depth, B, in which the former is placed, and which is designed to contain the water by which the gas is confined. To diminish, however, the quantity of water, this cylindrical vessel has a cone within it, also of japanned tinned iron, C, adapted to the shape of the gas-holder, so that this latter, when pushed down, slides between this and the cylindrical vessel, and a small quantity of water fills up the space between them. The vessel designed to contain the gas is suspended by cords hung over pulleys, to which weights are attached, so as to counterpoise it. From a stop-cock at the under part of the apparatus, D, there runs a tube under the cylinder, which rises and passes through the cone, the opening by which it passes being soldered so as to be air-tight: it terminates by an open mouth at the upper part of the bell-shaped vessel, A. This tube, at the part where it is bent at right angles, to ascend as has been described, is connected with another which also runs under the bottom, and ascends on the outside, terminating in the stop-cock, E; so that from the one stop-cock to the other, through the gas-holder, there is an uninterrupted passage. When the instrument is to be used, the stop-cock, E, is opened, and the vessel, A, pressed down, a sufficient quantity of water being in the outer cylinder; the air of the vessel is forced out by the pressure, and its place is occupied by the water in which it is thus immersed. When this is effected, the stop-cock is closed; and now, if we wish to introduce any gas into the apparatus, a bent funnel, the mouth of which is placed in a vessel of water, is attached to the tube of the stop-cock, D, as represented in the figure, and this stop-cock is opened. If the extremity of a retort, or of a tube, conveying gas, as represented in the figure, terminate below the orifice of the funnel, the gas will rise along the tube, will ascend to the top of the gas-holder, and this being counterpoised, will, as the gas enters, rise in the water, until it is filled, a quantity of water remaining around the mouth of it, by which the air is confined. When the gas is to be expelled, the stop-cock at D is closed, that at E is opened, a flexible tube is adapted to it, and the gas-holder being pressed down, either by the hand or by its own weight, from the removal of the counterpoising weights, a stream of gas issues from the extremity of the flexible tube, and may be transferred into a jar, or be applied to any other purpose, and its quantity may be measured by the instrument being graduated by a scale marked on the brass rod, F.

The instrument connected with the gasometer in the plate, is a convenient one for procuring gases from any solid substance, by the application of a strong heat. It is an iron bottle, A, into which is fitted, by grinding, a tube bent at an acute angle. To this a smaller tube is adapted, the extremity of which can be adjusted to various heights, by a circular joint in the middle of it, at *b*. The bottle containing the materials from which the elastic fluid is to be disengaged, is placed in a furnace, or in a common fire, so as to be raised to a sufficient heat; the gas issues at the extremity, and may be conveyed into the gasometer, or received in an inverted jar on the shelf of the pneumatic trough. At the end of the operation, the gas ceasing to be produced as the heat diminished, the water would be pressed into the tube, and might rise into the bottle, if the joinings were not opened. The easiest way of obviating this, is by having a small

stop-cock in the tube, as at *c*, which may be opened when the production of the gas has ceased.

THEORY OF WATER-SPOUTS.

(*Concluded from* p. 122.)

On the 28th of May, 1788, (says Dr. F. Buchanan) I observed a curved spout come from the cloud; at the same time, or at the next moment, I observed a thick cloud or fog arise from the sea: very soon afterwards, the spout rushed down and joined the cloud which had arisen from the sea, and at the same time this rose higher. The body of the spout tapered gradually downwards, and was seemingly more dense than the cloud from which it descended, but not more dense or black than clouds often are. The fog coming from the sea was of the same colour as the spout, and resembled the smoke of a steam-engine. During the whole time, the surface of the sea under the spout was evidently in a violent agitation, and full of white waves; at the same time a noise was heard like that of an *immense waterfall*. From the formation of the spout till it reached the cloud arising from the sea, appeared about two minutes. For two or three days the weather had been very unsettled, the wind seldom remaining two hours in one quarter, and sometimes blowing hard, and at others sinking into a perfect calm. Sometimes the sky was clear, and at others it *rained heavily*. Our latitude was about 20° 44′ S. On the 8th of January, 1789, the Doctor observed another; to the southward of it was heavy rain. About half an hour afterwards there was another, also with rain. In looking at this with a glass, I at first took it to be hollow, but I soon discovered that this was owing to the middle appearing lighter than the sides. It lasted about ten minutes, the rain continuing all the time, and seemed nearly as dense as the spout. The weather was very unsettled, with frequent showers. Lat. 3° 38′ N., long. 135° 26′ E. The Doctor describes another, which he saw in April, in the southern Atlantic Ocean, when the weather was also squally and showery.

We also know, Mr. Editor, that water-spouts, as they are called, are frequent on land.

"In the north of England (we are told, in the late Number of the Quarterly Review) a water-spout is called a *burst*." (In German they are also called bursts, but *cloud-bursts.*—Wolkenbruch.) "A cloud is attracted to the side of a mountain, in some manner not yet explained, and discharges its waters at once, instead of letting them fall in rain. This occurs frequently in the mountains of Cumberland and Westmorland. The name of water-spout, however, has not been applied to them without a reason; the appearance and motion of the cloud bearing some resemblance to what is observed at sea." "We happened," continues the writer in the Quarterly Review, "to see one burst upon Helvellin, at the distance of about eight miles; a sort of arm or spout, shaped like a funnel, descended from the bottom of the cloud, and was twice or thrice retracted before it appeared to touch the side of the mountain, when the whole cloud fell. Bursts such as this are said to be very frequent in North America." In August 1823, a very remarkable *burst*, or water-spout, as it is called, took place in the arrondissements of Dreux and Mante. The water-spout was described as having its broad base on the ground and its summit lost in the clouds. It consisted of a thick and blackish vapour. Advancing along with the storm, it tore up trees by the roots, destroying seven or eight hundred in the space of a league, and at last burst with great violence on the village of Marchepoy. One half of the houses were instantly demolished, and some of the ruins were carred half a mile by the violence of this aërial torrent. People were blown away by the whirlwind, and hailstones fell as large as a man's fist. Carts, heavily laden, were broken to pieces, and their

wheels were found 200 or 300 paces from the spot where they were destroyed.

I am not presumptuous enough, Mr. Editor, to offer an explanation of all these appearances; I only wish to combat the notion that water-spouts are ascending, for I believe them to be descending streams. I remember having been taught a different notion when a school-boy, and it was taught expressly to account for the rain which fell from the atmosphere. Either ancient philosophers were not sufficiently acquainted with the fact of evaporation, or they deemed it insufficient to account for the quantity of rain which constantly fell; and sailors having told them of these long black horn-like figures which come down from the clouds, they instantly jumped at the conclusion that these were to scoop up from the sea all the water which was found in the atmosphere. But at present it is admitted that it is very difficult to account for the ascent of water by them into the clouds. There can be no difficulty, however, in believing that the water descends from the atmosphere, though there may be some in accounting for the circumstance of its descending in a torrent, as it were, in one spot. What I mean to do is, to point out those circumstances which tend to support the opinion that water-spouts are descending, not ascending currents of water.

Captain Maxwell and Dr. Buchanan both state that the upper part of the water-spout was seen to descend before any thing was observed below; and both Captain Maxwell and the second witness whose testimony is given, state the foaming below continues a short time after the upper part has disappeared. From personal experience, I can state that this is correct; and is it not what should happen, on the supposition of a large body of water descending from the clouds into the sea?

Captain Napier, indeed, states that the first formation was below; but it is not difficult to suppose he might be in such a situation, so immediately under the black cloud, that he could not see the upper part of the spout, and therefore I doubt not his assertion, but that it actually commenced below.

Captain Napier expressly states that the water which fell was fresh, for which he is quite at a loss to account; and well he may be, supposing it just before carried up into the atmosphere; but supposing the spout to be a descending current, there is no difficulty in the matter, more than there is to account for the falling of rain. Every sailor knows that heavy storms sweeping over the surface of the ocean, carry the waters to a considerable height in the atmosphere; but they are never found fresh, but salt, covering the very highest masts and ropes with beautiful white crystals. Supposing, therefore, that the water were carried up by some kind of whirlwind or other mechanical means, it would have descended as salt as it went up. At least, we never heard that the cart-wheels, trees, &c. which were carried up on shore, descended in the form of whales or mill-stones. That the descending water was fresh, is a decisive proof that salt water had not been carried into the air.

But it is further remarkable, that all the witnesses agree the weather was generally rainy at the time when water-spouts were seen. The atmosphere was so much overcharged with moisture, that rain was falling all around. I can say from personal experience, that I never saw water-spouts except during rainy weather. It deserves also to be remarked, that water-spouts are more frequent in the tropics than in colder climates; and when meteorologists have discovered the cause why rain pours down there in pailfuls rather than in drops, they will have done much to detect the cause of water-spouts. A German philosopher, who saw something like water-spouts in the Baltic, says they wet all on board with drops of rain as large as cherries. It is plain, therefore, that at the time water-spouts form, the atmosphere is already overcharged

with moisture, and does not need to take up any more from the sea to disperse it over the land.

Further, Captain Maxwell observed, fine weather followed the appearance of water-spouts, and the mercury in the barometer became more convex. I, too, know that in general this is the case, which I hold to be another proof that the clouds had discharged the water by means of these spouts, not taken more up. The apparent motion upwards, mentioned by some observers, is accounted for by an observation of Dr. Buchanan's, that people are easily led to believe circumstances actually occur which they have been taught to expect. It is odd enough, that Captain Napier should have made an assertion of this kind, because he recognises the fact of the water descending, as described by Captain Maxwell. At the same time, it is to be recollected, that so large a body of water descending as to cause a prodigious deal of foam, would necessarily make some rise in the form of spray.

Another circumstance deserving notice is this:—All the observers agree in stating that in general the wind was light, at most it was only squally weather; and I can add from my own observation, that all the water-spouts which I ever saw appeared nearly stationary, and never did I see them but at a time when the wind was not violent. Now the whirlwinds on shore, which carry things up in the air, and which are supposed to be analogous to water-spouts, are not stationary, or nearly so, but pass over a small district with great rapidity. I do not say that such whirlwinds may never occur on the water, though I believe they never do far from land, or from spots where great and sudden changes of temperature take place; but I am sure that whirlwinds have little or no analogy with those black funnel-like things which are seen to descend from the clouds, which are dense at top, growing transparent as they descend, and occasioning a great foam and commotion when they meet the water. It is to me quite decisive of the question, that this commotion is, as Dr. Buchanan states, attended by a noise like that of an immense water-fall.

There is another analogy which deserves to be noticed. It has been remarked over and over again, that if a sea fight takes place in rainy or hazy weather, it has a manifest tendency to make the rain cease, and to clear up the haziness. Without stopping to account for this, which may perhaps be explained by the heat evolved, it is, however, remarkable that the sailors, as may be learnt from Captain Napier's account, fire guns also to destroy water-spouts. The fall of rain, therefore, is checked, and water-spouts broken or dried up by the same means. From all these facts, I think I am entitled to conclude that water-spouts at sea are analogous to bursts on shore. They are discharges of water, not into the clouds from the sea, but into the sea from the clouds. The only difficulty or obscurity in which the phenomena is involved is common to them with the formation of these bursts. What causes water suddenly to form in large quantities in particular spots in the atmosphere, and to pour that on the earth or into the ocean, is the question for philosophers to decide.

BIOGRAPHICAL NOTICE OF STAHL.

In our Number VIII. we gave a short notice of Beccher, who, on the ruins of alchymy, laid the foundation of modern chemistry. Ernest Stahl was his scholar and disciple, and contributed, by the splendour of his talents, and the zeal with which he cultivated chemistry, to raise it from the degradation into which it had been sunk by the tricks of the alchymists, almost to a level with the gentle art of poetry, and the more stern dignity of the mathematical sciences. He filled a high station, being first physician to the King of Prussia, and enjoying a brilliant reputation, conferred some of his own personal merit and

dignity on the sciences he cultivated. Chemistry was his favourite pursuit from his very infancy. He was born in 1660, and at the age of fifteen he could repeat the whole of the *Chemia Philosophica* of Barnerus, at that time the most celebrated book on the subject. As his knowledge increased, and his judgment ripened, he attached himself particularly to the writings of Beecher, whom he resembled in intensity of zeal, and surpassed in precision. Both were men of ardent minds, and active imaginations. He added much to the theory of Beecher, or rather he so remodelled it as to make it his own.—Like many of the continental philosophers, who seem in general to have been greater theorists than those of Britain, and more in haste to build up a glaring edifice than to lay solid foundations, he preferred establishing a system, and being the propounder of a theory, to discovering and arranging facts. He reduced all the phenomena with which he was acquainted into order, and sketched out a system which is complete, as a whole, and has as fair and imposing an aspect as any which has since been promulgated. We do not say he did not make researches, but they were made with a view to confirm his theory; and every fact he discovered, every experiment he made, served, in his hands, as a proof of his doctrines. He explained, after a manner, the phenomena of combustion; and though it is now known that his explanations were erroneous, it cannot be said that any others are yet, in all respects, satisfactory. His theory consisted in supposing that a certain substance, called phlogiston, forms a part of all combustible bodies; that the separation of this substance constitutes fire, and from its combinations resulted most of the other phenomena of chemistry. This theory was first developed about the beginning of the 18th century; and in 1723 Stahl published his *Fundamenta Chemiæ* (Principles of Chemistry). This book, and the opportunities he had, as Professor of Medicine and Chemistry, to propagate his opinion among the students,—for no method seems better calculated to give perpetuity to error, while it is also admirable for disseminating truth, than the practice of listening to doctrines which the *student* cannot challenge, and which, because only directed to students, are unchallenged by any other class of persons,—gained for Stahl a degree of admiration that was almost unbounded, and he was dignified by the name of the sublime Stahl. He was sought and followed by multitudes of students just as, in our own time, Kant, Fichte, Arndte, and Jahn, the professors of the science, popular at the moment in Germany, have been followed by crowds of admiring youth, and have been distinguished by names even more idolatrous than the epithet of sublime applied to Stahl. As in our time, when most of the philosophers of Germany have had little other employment than to comment on and elucidate the metaphysical system of Kant, so in the early part of the 18th century, the chemists of Germany did little more than endeavour, for upwards of fifty years, to confirm and establish the doctrines of Stahl; in fact, they spread over Europe. The *phlogistic* theory of chemistry prevailed in this country, till after the commencement of the French revolution; and not above a month ago, we saw it applied to explain some chemical phenomena in a very respectable cotemporary publication. In fact, this theory, applied so happily to many phenomena, enabling chemists to foretel results; and it was so much superior to any theory before promulgated, that we have no reason to be surprised at the admiration and attachment which chemists displayed for it in all parts of Europe. At length it was overthrown by Lavoisier; who succeeded in proving, that the products of combustion are heavier than the combustible body, and therefore no substance was separated, but one was added. Although the illustrious Frenchman

carried his ideas too far, and, like his predecessors, theorized too much, yet he completely overthrew the theory of the sublime Stahl, by proving that combustion is not a separation, but a combination.—Stahl died in 1734. Though his reputation as a chemist was deservedly high, his reputation as a medical man was still higher; and in Germany he is still regarded as one of the fathers of medicine.

SUBSTANCES FOUND IN MINERAL WATERS.

M. Berzelius has discovered lately in mineral waters, some substances that were not known to exist in them, viz.:—

Fluate of lime.
Carbonate of strontian.
Phosphate of lime.
Phosphate of alumina.

These were found in the mineral waters of Carlsbad, dissolved in uncombined carbonic acid. The tufas deposited by these waters are arragonitic, which confirms the idea of M. Stromeyer, that it is carbonate of strontian which determines the arragonistic form of carbonate of lime.

COMBUSTION.

To the Editor of The Chemist.

Sir,—Having read the Articles on the subject of combustion being promoted or assisted by the poker being placed over fire, the only theory I can suggest for the phenomenon, (which I think really exists) is, that the steel of the poker, assisted by the heat of the ignited embers, separates a portion of the oxygen from the atmospheric air immediately over them; as, in the gun-barrel experiment, the iron of the barrel, assisted by heat, is known to separate the oxygen from the hydrogen of the aqueous vapour passing through it.

I conceive that, when the poker is placed over the fire, the separated oxygen being heavier than the common air, descends upon the embers; and I need hardly observe that, if that be the fact, it will support or assist combustion more than the common air.

Your humble servant,

May 4. A. B.

This is an ingenious enough conjecture; but our Correspondent should have recollected, that iron only decomposes the aqueous vapour by combining with its oxygen. It absorbs the oxygen, but sets the hydrogen at liberty, and consequently there is no *separated* oxygen to promote combustion. A. B. will, therefore, see the necessity of having a knowledge of facts before he hazards conjectures.—Ed.

VELOCITY OF SOUND.

A paper has been read at the Royal Society, giving an account of some experiments lately made in Holland, on the velocity of sound, by Drs. G. A. Moll and A. Van Beck. The experiments were made on the plains of Utrecht; and care was taken to annihilate the effects of the wind. The stations were 9964 feet apart; and the velocity ascertained, by determining the interval between the flash and the report of guns, by means of clocks with conical pendulums, dividing 24 hours into 10,000,000 parts. The result was, that at the temperature of 32_o, the velocity of sound is 1089.7 feet per second.

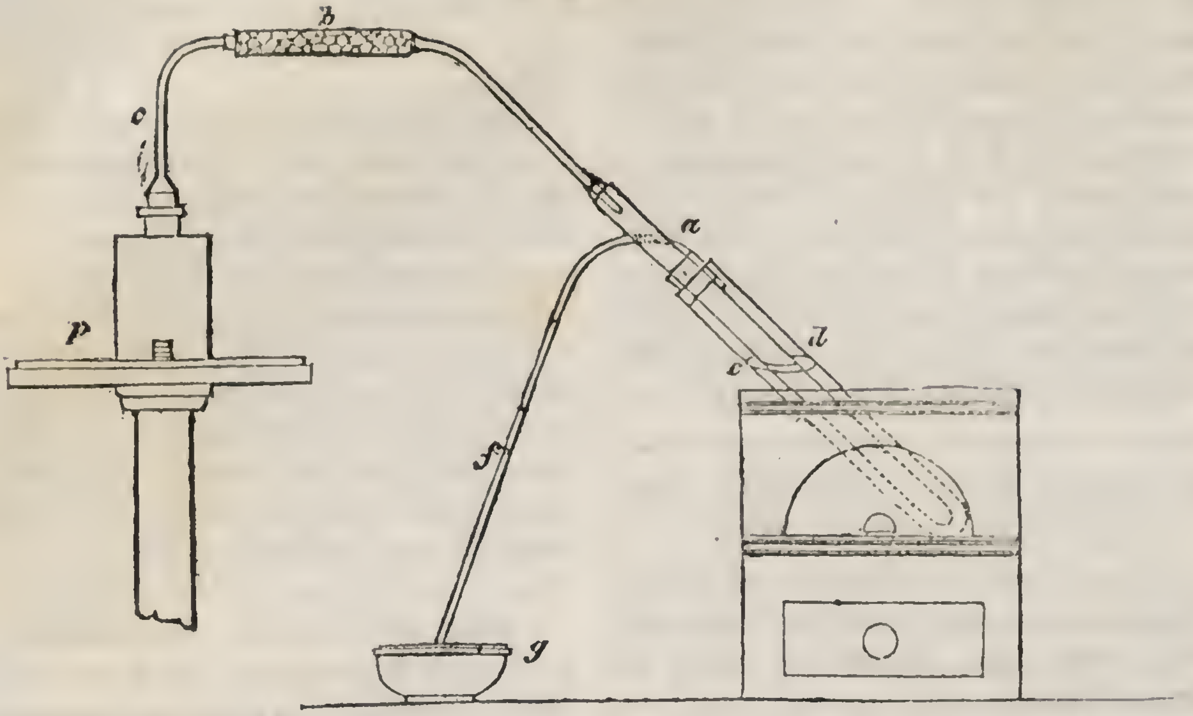
SIMPLE TEST FOR OXALIC ACID.

Mr. Editor,—Observing in The Chemist, No. VII., that you recommend the tasting of salts to distinguish them from oxalic acid, permit me to point your attention to a test, which is almost always at hand, and which is sufficient to distinguish oxalic acid from Epsom salts. Dip a pen in common black ink, and apply the point to the substance; if it be oxalic acid, the black ink will instantly assume a red appearance, and in a short time will be converted into red ink. With Epsom salts no such effect takes place.

Yours,

Homely.

Plate I.



ANALYSIS OF FULMINATING SILVER.

BY MESSRS. LIEBIG AND GAY-LUSSAC.

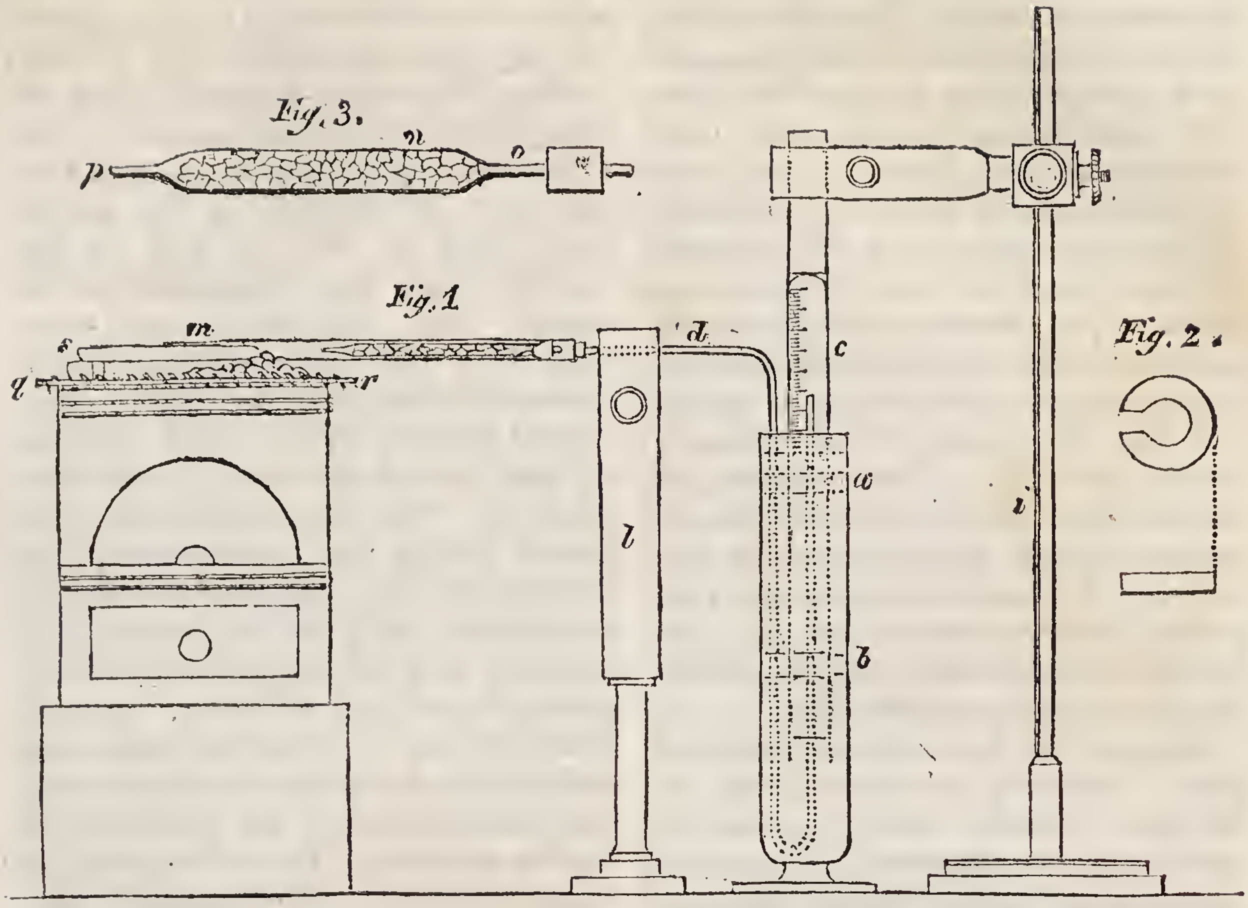
(*Abridged from the Annales de Chimie et Physique.* T. xxv.)

THESE gentlemen begin by saying, that the analysis which one of them published, of fulminating silver and mercury, in the twenty-fourth volume of the *Annales*, had for its object to prove that these compounds are salts, formed with peculiar acids, which could be separated and combined with their respective bases. This analysis was not satisfactory; and they, therefore, associated to make another set of experiments. The difficulty which has hitherto been experienced in obtaining the products of this compound when decomposed, makes us think it of some importance to describe the means by which these gentlemen accomplished it. They prepared fulminating silver, by dissolving a half *franc* piece of silver coin in 45 *grammes* (about 1½ ounce) of nitric acid, pouring the solution, when completed, into 60 grammes of alcohol. The alcohol, when made to boil, soon became thick, and fulminating silver began to be deposited. The vessel containing it was immediately removed from the fire, and successive portions of alcohol added, to diminish the ebullition, till the quantity was doubled.—It was then allowed to cool; the fulminating silver was thrown on a filter and washed with distilled water, till no more acid was separated. The fulminate was then as white as snow, and as pure as if the purest silver had been employed. It was taken from the filter and spread on a plate, covered with paper, placed over a vessel with water, which is made to boil during two or three hours. Generally, a quantity of fulminate was obtained equal to the quantity of silver employed; the third part more, which ought to be obtained, remains in solution in the acid and in the water.

Fulminating silver never detonates by itself at the temperature of 130°; but it must be carefully guarded from the slightest blow between two hard bodies, even when it is in water. It is better, therefore, to use wooden rods instead of glass ones; and care should be taken to place the vessels in which it is put on several folds of paper. It is prudent, also, to handle it with paper spoons; for the detonation even of the smallest quantity of it in the hand, would certainly cause the loss of this limb.

Having ascertained that, if mixed with forty times its weight of pure oxide of copper, it might be pulverized in a mortar, by means

Plate II.



of a cork, or the finger, and that it did not then explode on exposing it to the action of heat, we employed (they say) this means for determining in what state the carbon and azot existed; and we found, that in the fulminating silver, or rather in the fulminating acid, there were two volumes of carbonic acid and one volume of azot, or the same proportion as in cyanogen, or, as it is called by some English chemists, prussine. The whole of the oxide of silver, which seems divided into two portions, one serving as the base of the salt, and the other being an element of the fulminating acid, may be obtained by decomposing the fulminate by hydrochloric acid, and evaporating to dryness. Towards the close of the the operation, a small quantity of nitric acid is added to destroy a small quantity of sal ammoniac, which is formed by the decomposition of an acid, to be hereafter described. Taking the mean of two experiments, fulminating silver contains 77.528 parts in the 100 of oxide of silver; or, silver 72.187, oxygen 5.341.

Having thus ascertained the quantity of oxide in fulminating silver, they then proceeded to determine the other elements. The fulminate was decomposed by oxide of copper; and the following means were employed to procure the substances perfectly dry, which these chemists describe at length, because it is applicable to any substance, whether animal or vegetable. After mixing the fulminating silver with the oxide of copper, the mixture was introduced into a thick glass tube, about four lines in diameter in the bore, and 13 inches long, *a*, plate 1; this was connected with a tube, *b*, containing chloride of calcium, (muriate of lime) which was adapted by means of a flexible leaden pipe, *c*, to a small receiver placed on the plate, *p*, of an air-pump. In exhausting the air of the apparatus, the vapour of the water is also carried off, and does not enter the tube containing the mixture, which is dried by the chloride of calcium. But still further to abstract the hygrometic water of the mixture, the tube which contains it is plunged across a cork into a tube of large diameter, *d e*, full of water, which is made to boil; the vapour escapes by the tube, *f*, and the water which condenses falls into the vessel, *g*, placed below. By alternately exhausting and filling the apparatus

with air, the substance loses all its hygrometic water. For other substances, which are not decomposed by a temperature above 100°, the tube containing the mixture may be heated in a saline or acid solution, or in an oil bath. The joints of this apparatus may all be made of cork; and when it is of a good quality, the vacuum can be made perfect, without any luting or varnish, except a little paste or fat put into the pores of the cork, if there are any. The mixture of fulminating silver and oxide of copper being decomposed by the action of heat, the gases are collected in an apparatus of the following description, which shows their volume immediately:—

Fig. 1, plate 2, *a b*, is a bell-shaped glass, to which two open rings or handles of cork, one at *a* and the other at *b*, are attached, the use of which is to direct the movements of the small graduated jar, *c*. The tube, *d*, to conduct the gas into the graduated jar, has two vertical parallel branches, the ascending part of which almost touches the upper part of the graduated jar, when it is at its lowest position, and the other passes outside of the graduated jar, between the two openings of the cork rings. Fig. 2 represents one of these rings. The vessel *a b* being filled with mercury, and the ascending branch of the conducting tube being inserted in the graduated jar, this is immersed in the mercury, and the air gradually escapes by the conducting tube. The jar is kept in its new place by means of a cork fixed in a piece of wood, *h*, sliding along a vertical rod, *i*, on any part of which it may be fixed at pleasure by the pressure screw, *k*. The mercury in the graduated jar is brought to the level of the mercury in the lower vessel, and the volume of air in the graduated jar is correctly marked, as well as its temperature. When the mixture is decomposed, the extricated gases force down the mercury in the graduated jar; but by moving the wooden hand along the rod, the mercury is constantly preserved at its original level, adding mercury at the same time to fill up the space left by the jar rising out of the bath. When the decomposition is completed the fire is removed; and after the apparatus is cooled, the mercury is brought to the same level, both in the jar and in the basin, and the temperature is noted. The volume of air contained in the graduated jar after the operation, less the air it contained before, will be the volume of gas resulting from the decomposition. The water which is produced during the operation by the decomposition of any hydrogenated substance, may be collected by making it pass into a tube containing muriate of lime, placed between the conducting tube and that in which the mixture is placed; but the following is, perhaps, a better method. Take a very small tube, *n*, Fig. 3, the exterior diameter of which is equal to the interior diameter of the tube, *m*, containing the mixture. To this a smaller tube, *o*, filled with chloride of calcium, is attached, to which a cork is adapted, so that it will just enter into the tube, *m*; its weight is determined, and it is placed in this tube, as seen in Fig. 1; the gases then have no other means of escape but over the chloride in which they deposit their moisture. When the mixture is introduced into the tube, *m*, care must be taken to leave a space, *m s*, at the upper part of the tube, that the smaller one may not be thrown out of its place at the moment when the gases are disengaged. To effect the decomposition of the mixture, a small furnace is better than a spirit lamp.

From several experiments made according to this mode, these chemists determined the quantity of cyanogen in 100 parts of fulminating silver to be 17.160, and the whole to be thus composed:—

Silver	72.187
Oxygen	5.341
Cyanogen	17.160
Loss	5.312
	100,000

It is therefore composed of—

2 atoms of silver.
2 of oxygen, combined with silver.
2 ditto, combined with the elements of the fulminating acid.
* 2 cyanogen $\begin{cases}\text{2 atoms of azot,}\\ \text{4 of carbon.}\end{cases}$

CHEMISTRY AS A SCIENCE.
Art. X.
PHOSPHORUS.

The thirst for wealth and distinction, so prevalent among men, must, we are inclined to believe, like every thing extensively diffused, have been implanted in us for good. It has, nevertheless, been much stigmatized by those moralists, who notice only the deviations from the general and regular course of nature. They are men, whose attention is arrested exclusively by what is glaring, like detected crime, or dazzling, like successful ambition; and they record only the hurricane of our passions, forgetting that this is but the momentary interruption of their gentle and perpetual flux and reflux, which, like the trade winds of the tropics, impart health, freshness and vigour to the whole circle of existence. More pleasing, and we will add, more correct, observers, who remark rather the general effects of our passions than the exceptions, say, on the contrary, that the thirst for wealth and distinction is the source of almost every improvement in the condition of man. It strengthens the love of liberty, and kindles the spirit of invention. By it the toiling mechanic is kept steady to his task, and the adventurous seaman induced to brave all the dangers of the ocean; spreading not only the different products of the globe more equally over every part, but also every where diffusing knowledge and civilization, so as to bind the whole human race in one general community, having a common interest and a common fate. The alchymists supply an individual example of its beneficial effects in adding to our knowledge. There was no substance, however disgusting, which, in their search after the philosopher's stone, they disdained to examine: and to their intense desire for wealth, we are indebted for a knowledge of the chemical properties of several substances, the repugnance to which is so great, that, but for this powerful motive, men would always have scrupulously avoided them. We have been led to make these observations, by the fact, that *phosphorus*, the subject of this paper, was discovered in the year 1669 by an alchymist of the name of Brandt, living at Hamburgh, who was endeavouring to procure a liquid from urine capable of converting silver into gold. We are not sure that the substance was before totally unknown to some adepts: the numerous visions on record; the various tricks, of which the history is preserved, both in the books of modern Europe and in more ancient works, seem to show that the priests of the dark ages and the magi of the east were acquainted with phosphorus, or some equivalent substance. If so, it was afterwards lost, till recovered by the discovery of Brandt. This, though accidental on his part, may be said to have made it known to the scientific world; and the knowledge of it, as long as any use can be made of it, will probably never again be lost. Brandt showed a specimen of the substance he had discovered to Kunkel, a German chemist of some eminence, who mentioned the fact, as a piece of news, to a Mr. Kraft, a friend of his, at Dresden, who immediately repaired to Hamburgh, and purchased the secret from Brandt for 200 dollars, exacting from him, at the same time, a promise not to reveal it to any other person. Kunkel was vexed at the treacherous conduct of Kraft, and

* If the reader turns to the *Quarterly Journal of Science*, No. 33, page 156, he will there find the results stated of some former experiments by Mr. Liebig. They differ so much from these experiments, that we cannot help reverting to them as an additional proof of what we stated at p. 139, viz. that little confidence can be placed in the analysis of the secondary compounds.

set about discovering phosphorus himself, in which he succeeded, about 1674, though he only knew from Brandt that he obtained it from urine. This, probably, had the effect of preventing Kraft from realizing a fortune by his acquired secret. He came to England, and went to France, exhibiting his phosphorus for this purpose. He says, that he taught the celebrated Boyle the mode of making it; but Boyle, whose authority is much better than that of Kraft, affirmed, that he discovered phosphorus himself, without being previously acquainted with the process. Boyle revealed the mode of making it to his assistant, Godfrey Hankwitz, an apothecary, who for many years supplied all Europe with phosphorus. In 1737, the French government bestowed a reward on a stranger, who appeared at Paris, and communicated a process for making phosphorus. The French chemists, to whom this communication was made, described the process as very tedious; and, soon after, several improvements were made in it. Scheele, the Swedish chemist, discovered a method of obtaining phosphorus from bones, which, though somewhat improved, is the method now generally adopted by those who manufacture phosphorus on a large scale. The chemist may obtain phosphorus as follows:—

Let a quantity of bones be burnt, or, as it is termed in chemistry, *calcined*, till they cease to smoke or to give out any odour, and then reduce them to a fine powder. Put 100 parts of this powder into a bason of porcelain or stone-ware; dilute it with four times its weight of water, and then add, gradually stirring the mixture after every addition, 83½ parts of sulphuric acid. The mixture becomes hot, and effervesces; a great number of air bubbles escape. The mixture is left in this state 24 hours, and is stirred every now and then with a glass rod, to make the acid act on the powder. At the end of that time the whole is to be poured on a filter of cloth. The liquid which runs through the filter is to be received in a porcelain bason, and the white powder which remains on the filter after pure water has been poured over it repeatedly, may be thrown away, as of no use. Pour nitrat of lead, dissolved in water slowly, into this solution, a white powder immediately falls to the bottom, and as long as it continues to fall, nitrat of lead must be added. The whole is then again to be filtered, and the white powder which remains on the filter is to be well washed, allowed to dry, and is then to be mixed with about one sixth of its weight of charcoal powder. Put the mixture into an earthenware retort, and place the retort in a furnace, plunging its beak just under the surface of a vessel with water. The retort is to be gradually heated to whiteness; a vast number of air bubbles issue from its beak, some of which take fire when they reach the surface of the water, and at last there drops out a substance which has the appearance of melted wax, and which congeals under water. This is the simple undecompounded substance, phosphorus. It must be purified by straining it through chamois leather under warm water.

It is of a light amber colour, semi-transparent, though when carefully prepared, it is nearly colourless and transparent. It is as soft as wax, but more cohesive and ductile. It is insoluble in water. Its specific gravity is 1.77. It melts at 99° Fahr., and boils at 550°. When melted, care must be taken to keep it under water, for it is so combustible that it is very likely to take fire. It is soluble in alcohol, ether, and oils, the solutions being transparent. When water is added to the alcohol or ether, the phosphorus separates and burns at the surface of the liquid. If the oily solution be poured on paper, and carried into a dark room, of the temperature of 60°, it shines vividly: at lower temperatures the light is scarcely perceptible. Phosphorus, when taken internally, is poisonous; and it is

related in the *Annales de Chimie*, that a great number of fowls and turkeys were poisoned by drinking the water in which some newly-made phosphorus had been washed. The blubber-like substances which are found in salt water are known to be phosphorent, and, at the same time, poisonous to poultry, which devours them greedily. Phosphorus has been successfully employed in stopping mortification and curing malignant fevers. Its use in making matches is well known. It is also employed in making phosphoric ether, phosphoric oil, and phosphoric acid.

In the atmosphere, if the temperature be not very low, phosphorus emits a white smoke, having the smell of garlic, which, in the dark, is luminous. The higher the temperature is raised, the more abundant does this smoke become: it results from a combustion of the phosphorus, which is at length entirely consumed. If the air be perfectly dry, the phosphorus does not smoke, because the outside then becomes closely encased with a species of rust, which prevents the action of the atmospherical oxygen. When phosphorus is burnt in oxygen gas, the light and heat are intense; and if the experiment be made in a close vessel, the result of the combustion is found to be what is called phosphoric acid.

Phosphorus is never found native, and is entirely the production of art. It is, however, conjectured, as it is an animal product, that the myriads of animalculæ which, as they float in the deep sea, make it like a vast sheet of low and lambent flames, marking every ripple of every wave, every stroke of an oar, and the track of every boat and every ship, with a flash of fire, or a deep and lasting streak of light, produce this effect by the constant emission of phosphorus. The glow-worm and the fire-fly, as well as many other animals, shine by their power of generating and emitting phosphorus. Being scarcely found in any other combination but as it exists in animals, it is regarded as exclusively an animal product. It has been conjectured also that it is not, and cannot be, a simple substance; and that its elements are contained in some of the substances on which animals subsist. Certainly it has no claim to the character of an element, except that all-paramount one in chemistry, it has never yet been decompounded.

COTTON.

Perhaps there is no plant, not even the potatoe, on which the prosperity, the comfort, and even the existence of so large a portion of the people of this country now depend, as on cotton. According to Mr. Huskisson's speech in the House of Commons, on Monday, March 8th, 1824, no less than 1,200,000 persons are employed in our country in the cotton manufacture. This number, which does not include the merchant who sends the manufactured article abroad; the seamen who bring home the raw material, and who carry it away when manufactured; the shopkeepers who vend it in the country; nor the persons who make the machines by which it is manufactured,—is about one-seventeenth of our whole population. It is a startling reflection, that this plant is not the produce of our soil, and cannot be cultivated in our climate. The vast number of persons above-mentioned, with all who depend on them, are dependent for the means of subsistence and comfort on a plant cultivated by foreigners, living in climates different from our own. When we reflect on this circumstance, the state of our country strikes us as being very remarkable, and, we had almost said, full of danger. It is, perhaps, even still more remarkable, that a large portion of our people partly subsist on another foreign plant, which can never be naturalized in England. Very nearly 3,000,000 pounds of tea, independent of the quantity smuggled, are annually consumed in Great Britain. And so pleasant and refreshing is this beverage, that we have no

doubt more than double the quantity would be consumed, were it not for the monopoly of the East India Company. It has been demonstrated, that this enhances the price of tea threefold more here than its price at New York, in America, and at Hamburgh, in Germany; levying an annual tax on the people of this country, in addition to forcing them to consume a bad article when a good one might be procured, of two millions two hundred thousand pounds sterling. In Holland we know, from experience, that the tea is excellent; and at every tavern and public-house in that country, where carriages or track-boats are liable to stop, tea is kept always ready made. We believe, if the commodity were as cheap as it might be, this also would be the case in our country. It may, however, be thought, that it is good policy to lay restrictions on its use; and that no trouble ought to be spared, no expense grumbled at, and no measures be called obnoxious which have a tendency to discourage the use of foreign productions. We do not mean to enter into the consideration of this question; but we know that, under the influence of the ancient theories of political economy and of trade, the situation of this country, in the points we have mentioned, those of drawing a portion of its subsistence and of the materials of its labour from foreign countries, would be spoken of as pregnant with misery and danger. Juster notions of the mutual relations of nations, and a conviction that the interest of the producer, as well as that of the consumer, would be equally injured by the suppression of foreign traffic, teach us not to regard this part of our situation as making us in any manner dependent on foreigners, more than they are on us; and that the interest of both would suffer by the cessation of this trade, is the best security either can have against the wanton and destructive ambition of the other. As these mutual commercial relations, or, if the reader will, mutual dependencies of bodies of men politically grouped into nations, grow more extensive, the interest of all to maintain peace and good-will with one another becomes more apparent and binding; and, perhaps, we are indebted for much of the political hostility which now exists between the French and English people, who by their proximity, and yet living in different climates, nature intended to be the best of friends, to those anti-commercial regulations, which, it is well known, have forbidden almost all trading intercourse betwixt them. The increased consumption or use of foreign products, seeing too that they must always be paid for by the products of our own industry, is therefore, politically speaking, only a security which the peaceable, industrious citizens of a community have, that their wealth and prosperity will not be checked by the wanton ambition and wars of their rulers. We thought it right to couple the statement of the number of persons employed in the cotton trade with these few observations, that we might not beget any alarm in our readers for the continuance of that prosperity, on which the welfare of so many persons depends. We shall now proceed to the proper business of this Article, which is the first of a series of Articles, in which we intend to describe the growth and culture of this foreign plant, manufacturing, conveying, and selling which employs, perhaps, at least one million and a half of our people.

The cultivation of cotton is not confined to one country, but is pursued more or less in many parts of the world situated within thirty-five degrees of the equator. Beyond this latitude it would appear the cotton-tree cannot be successfully cultivated. The principal places, however, where it is cultivated are the East and West Indies, the southern states of the republic of North America, the islands in the Mediterranean, and the dominions of the Grand Signior. It may be of some satisfac-

tion to the political part of our readers to know that cotton is produced by a considerable number of the colonies belonging to Great Britain. Great quantities are grown in our possessions in India; but owing to the great distance, only a small quantity is imported from thence into Britain. North America and the West India Islands supply about one third of our consumption, Brazil another third, the remaining third being supplied by other and different countries. There is little or no chance, therefore, of the supply from them all being interrupted at the same moment; and in either country where it is now produced, it might be cultivated to almost any extent, if the demand required it. The different sorts of cotton imported are, 1st. Smyrna wool, formerly the only cotton known in England, though now only met with in very small quantities. It is soft and silky in its appearance, but weak and short in its fibre; not well fitted to undergo the fatigue of the manufacture, and producing cloth neither beautiful nor durable. 2d. West India cotton is in general coarse, long in the fibre, and well adapted for stout and coarse cloth, but not fit for light and fine goods. 3d. East India cotton is of various qualities; that known by the name of Bourbon is very superior, both for strength and fineness, and is the principal cotton used for yarn of the finest kinds. A coarser kind is imported, which is hardly capable of being spun. 4th. South American cotton is chiefly distinguished by the names of Pernambuco and Maranham, from the two districts of Brazil where it is chiefly cultivated. The latter of these is inferior, both in strength and cleanness, to the former, which is equal to any cotton imported. 5th. The Demerara, Berbice, and Surinam cottons resemble in general the West India cotton; though that imported from Demerara, on account of the attention paid by the Dutch to cleanse it, fetches a higher price than the others in the market. 6th. The cotton from Georgia and South Carolina is of two kinds, called Sea Island and Bowed; the former being superior to any cotton known except the Bourbon, and the latter being even inferior to the West India cotton. This enumeration must satisfy our readers, we should suppose, that there is no danger of our supply of cotton being limited. In fact, the inhabitants of both the Brazils and of the southern states of the republic of America are in a great measure dependent for their supply of European commodities, without which life has for them little value, on the sale of their cotton in our markets; and for them to cut off our supply would be a greater injury to them than to us. We could get cotton elsewhere; but without they sold their produce, it would be as impossible for them to procure their supplies of other commodities as it lately was for our farmers to pay their rent, because they could not sell their produce.

It is rather a remarkable circumstance in the history of cotton, although it was known from the earliest ages, that it has only come extensively into use in Europe within the last fifty years. In the year 1765, cotton, as an article of commerce, was scarcely known in this country. In 1767, Richard Hargreaves invented the Jenny; and from that time to the present, the increase in the manufacture of cotton in this country has been rapid beyond example. This is one of those circumstances which deserves to be borne in mind, as showing the connexion which exists between the various arts and manufactures. Moreover, it may serve to teach us confidence in the order of nature, and justify a hope that, however difficult the situation of mankind may appear; however limited in space, or checked in their progress of prosperity or happiness, there are always resources in store, which are opened up at the time of the greatest need, and just as the current seems about to stagnate, another flood of human prosperity and improvement sets in. By the mechanical inventions

of Britons, of which the spinning Jenny was, in this particular branch, one of the first, cotton came of a sudden to form, perhaps, a half of the clothing of all the people of Europe. Not only by this was Great Britain enriched, and enabled to nourish a continual increase of people, which, without this, must have been still more checked, producing, in an increased degree, all those miseries by which population is kept under in all countries; but foreign lands, which would have remained sterile and unprofitable, came into useful employment, and a great increase also took place in the number of people who cultivate cotton. The fields of Europe, which must otherwise have been employed to provide clothing for its people, were appropriated to the cultivation of food. As it increases in population, this effect will be carried to a greater extent; and it may be asserted, though Richard Hargreaves could foresee none of the consequences of his invention, that it has already contributed perhaps to double the population of our own country, and will contribute to multiply the population of the whole world. As two heads are wiser than one, and as it is an established fact, that as men multiply so they increase in knowledge, it would therefore appear, that the invention of an illiterate man, who lived in obscurity and died in poverty, suggested also, it is said, by an accident, and named, apparently in ridicule, a Jenny, has been a cause of improvements too great for an individual to calculate.

(*To be continued.*)

TO CORRESPONDENTS.

G. S. . ll will readily believe that we did not cease to give an outline of Mr. Phillips's Lectures, which was begun, supposing they would be of interest to many of our readers, and of which he requests the amplified continuance, without good reason. The fact is, that Mr. Phillips's Lectures at the Mechanics' Institution being gratuitous, and he having expressed to the Editor his wish not to have them noticed, as he intended to publish them himself, we felt ourselves bound instantly to accede to his wish.

A constant Reader, F. E., will find what he requires in our next.

The communications sent by A Chemist are in the hands of the Printer and Engraver; and if one of them does not appear in the present Number, it will be owing to the Plate not being prepared. His other communication in No. XI.

*** Communications (post paid) to be addressed to the Editor, at the Publishers'.

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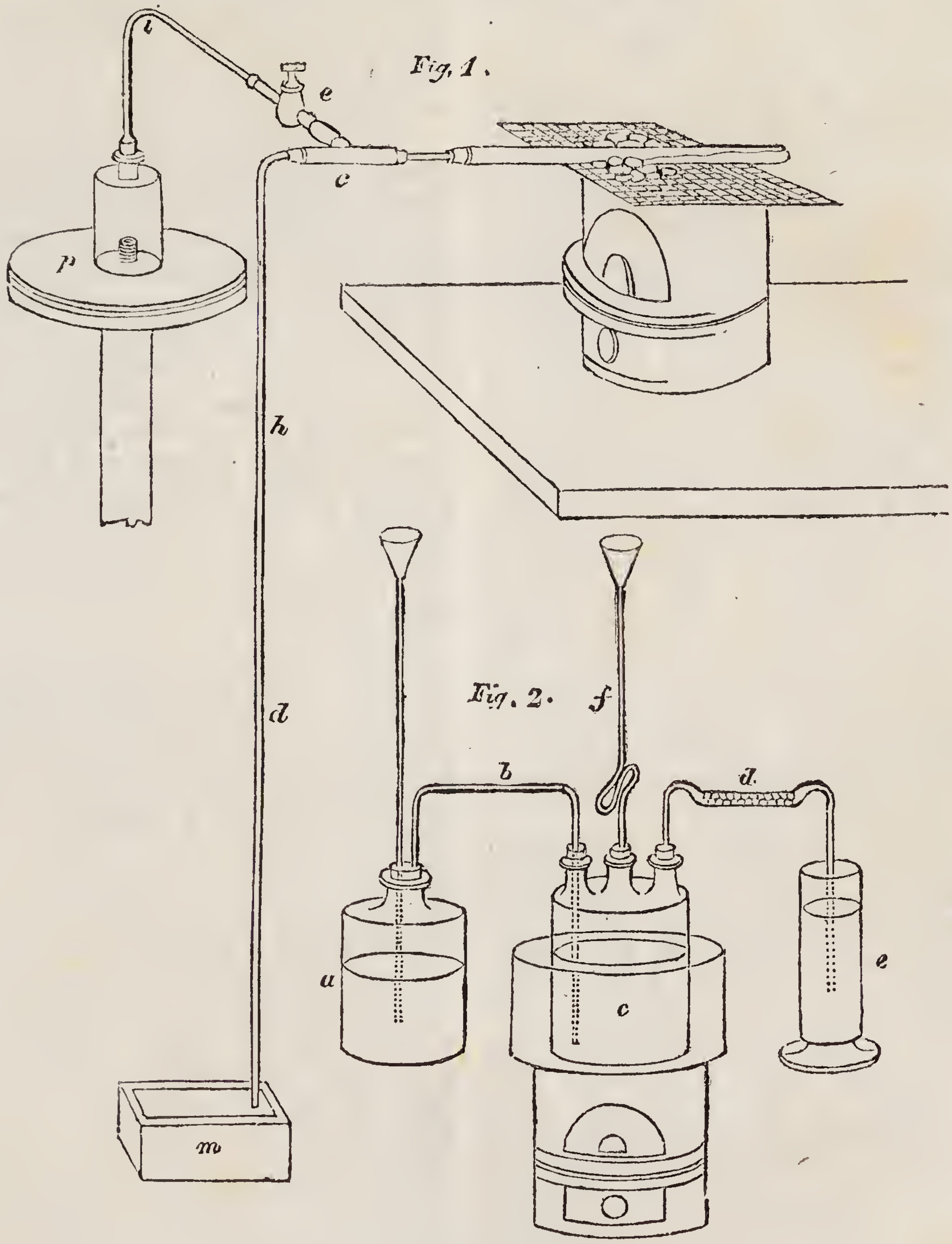
The Chemist.

"—— Search, undismayed, the dark profound
Where nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. XI.] SATURDAY, MAY 22, 1824. [Price 3*d*.



CONTENTS.

ANALYSIS OF FULMINATING SILVER.

(*Continued from* p. 155.)

The two chemists whose paper we are now translating, found by their analyses, that fulminating silver does not contain oxygen enough to convert all its carbon into carbonic acid ; but they found it difficult to ascertain what quantity more would be required. They endeavoured to obtain the products which result from detonating fulminating silver, and made some experiments for this purpose ; but there was so much danger in this mode of operating, the vessels bursting with the smallest quantity of fulminating silver, that they were obliged to desist. They found it easy, however, to determine the products of its decomposition, by mixing it with substances which did not supply it with oxygen. At first, glass reduced to an impalpable powder was employed ; but detonation was the consequence, and they were obliged to desist. Chloride of potassium and sulphat of potass were then alternately employed ; and the decomposition effected with them confirmed the opinion previously formed, that there was no hydrogen in fulminating silver.

As the fulminating silver gave two different portions of gases, one with the oxide of copper, and the other with the sulphat of potass, another experiment was undertaken to ascertain the nature of each. To obtain the first portions of the gas pure, a vacuum was produced in the apparatus. To the tube containing the mixture, a brass tube, *c*, Fig. 1, was adapted, and it was connected with a glass tube, *d h*, to receive the gases, which was somewhat more than a yard long, and plunged into a mercurial trough, *m*. Towards the middle of the brass tube there rose another at right angles, *e*, having a stopcock, and communicating with a pneumatic machine, *p*, by means of a leaden pipe, *i*. In producing a vacuum in the apparatus, the mercury could not rise above *h*, about equal to 29 inches, and then turning the stop-cock, all communication between the air-pump and the apparatus is cut off. By making use of this contrivance, it was found that the gas produced during the decomposition of the fulminating silver with sulphat of potass, consisted of two parts in volume of carbonic acid gas and one of azot; and that obtained by distilling the remainder with the oxide of copper, contained 100 parts of the former gas, and 37.4 of the second.

As the result of all their experiments, these chemists state it as their opinion, that all the fulminates are sub-salts, the acid of which does not contain any metal as essential to its composition, and is composed of oxygen and cyanogen. The fulminating principle, therefore, common to the fulminates of all the metals, is composed of oxygen and cyanogen, or rather of oxygen, carbon, and azot. The fulminates are all supposed to form a particular species of salts, the acid in which is the cyanic.

These chemists then made some attempts to form fulminates of the other metals ; and they treated copper in the same manner as silver or mercury. They did not succeed, however, in forming fulminating copper ; but in saturating the acid liquid with potass, a precipitate was formed of a beautiful green, which did not detonate, and which is completely dissolved in an excess of acid, the solution taking a blue colour, like a solution of copper in ammonia. This proves that the oxide of copper is combined with some particular substance. These chemists were unsuccessful in their endeavours to obtain the fulminating acid separate from the base, though they found that the hydrochloric, hydroiodic, and hydrosulphuric acids decomposed fulminating silver at the common temperature of the atmosphere. With hydrochloric acid much hydrocyanic acid was disengaged, and a peculiar acid formed, containing chlorine, carbon, and azot. This acid was obtained

by pouring gradually hydrochloric acid on fulminating silver, till the filtered liquid was no longer troubled. Its taste is sharp; it reddens the blue turnsole paper; does not precipitate nitrat of silver; it neutralizes the bases, and then acquires the property of colouring of a deep red the perchloride of iron. From the results obtained, these chemists were led to suppose that the chlorine in this acid was combined with hydrogen; and to ascertain this they instituted the following experiment:—

They put a known weight of fulminating silver with water into a vessel with three openings, *c*, Fig. 2, placed in a water-bath, and hydrochloric acid was then poured on the fulminate by the tube, *f*. To facilitate the volatilization of the hydrocyanic acid, a current of hydrogen gas was supplied by the tube, *b*, from the bottle, *a*, which contained zinc and diluted sulphuric acid. The hydrogen gas traversed a tube, *d*, containing fragments of marble and a little water, and then escaped across a solution of nitrat of silver contained in the vessel, *e*. By this means these chemists expected to obtain cyanide or prussiat of silver; but to their surprise no precipitation took place, although they had previously ascertained that the same solution of silver gave an abundant precipitate when hydrocyanic acid was poured into it. In conclusion, these chemists remind the reader, that all the fulminating compounds detonate with great facility, even in water; and that the experimenter should not use glass rods to stir the liquid, in which they may be suspended without being dissolved. By using these rods they caused some fulminating silver and barytes to detonate in a porcelain vessel: owing to a great part of the fulminate being in a state of solution, and it being hardly warm, no serious consequences resulted from this accident, which might otherwise have been fatal.

CHEMISTRY AS A SCIENCE.
Art. XI.
METALS, FORMING ALKALIES WITH OXYGEN.

We have hitherto treated of substances, most of which were unknown to our readers, but we now come to speak of a class of bodies, some of which are extremely familiar to them, namely, metals; but, in the first instance, of metals which have perhaps scarcely ever been heard of by some of our readers, and have yet only been obtained in such small quantities, as to have been put to no use. Chemists apply the term metals to a numerous class of undecompounded substances, distinguished by the following general properties, though some of them do not possess all these properties:—They are of a peculiar lustre, which belongs to the smallest particle of them; they are opaque, fusible, conductors of electricity and heat; are malleable, that is, extend or spread out when struck with the hammer; are ductile, that is, may be drawn into wire; and when exposed in combination to the action of electricity, they separate at the negative pole.—With gold, silver, iron, copper, lead, &c. every European is intimately acquainted; they have been known, in fact, from the most remote antiquity; but potassium, sodium, lithium, calcium, and others, were only discovered very lately, and by the application of very powerful instruments. In describing each of these substances more particularly, we shall advert shortly to its history; and shall, therefore, now only observe, that those which have been longest known are still the most useful. So great were the advantages which the discovery of them conferred on the early inhabitants of the world, that the first metallurgists, like the first improvers of agriculture, were deified; and Vulcan, in the ancient mythology, was of a rank at least equal to Ceres. Those who love trifling discussion have, indeed, raised a question, whether the taming of animals, or the discovery of metals, has had the most influ-

ence on the improvement of society: this may, however, be safely asserted, that neither would have been so beneficial without the other, and both have been eminently serviceable. Without the metals, many of the arts and sciences could hardly have existed; and without the taming of animals, the means of subsistence must always have been small and precarious.

The class of metals of which we are now to speak, was discovered only a few years ago, and with their properties we are yet very imperfectly acquainted. Prior to 1807, the substances which are probably known to our readers by the names of *potash* and *soda*, and another alkaline substance called *lithia*, obtained from a mineral called petalite, were considered and classed by chemists as a distinct species of substances called alkalies, which were simple and undecompounded. Prior, also, to that period, the earthy and stony substances of the globe had been all reduced, chemically speaking, to a certain and not a large number of substances, which were called earths and metals. At that period, however, Sir Humphry Davy succeeded in decomposing potash. He placed thin pieces of potash, slightly moistened, on a plate of platinum, attached to the negative end of a powerful galvanic battery, and brought a platinum wire from the positive end of the battery to its upper surface. The potash was gradually decomposed, oxygen gas was evolved at the extremity of the positive wire, while globules of a white metal like mercury appeared at the opposite side, in contact with the plate of platinum. Sir Humphrey verified this fact by numerous experiments, and all the chemists of Europe have adopted his opinion, that these globules are a peculiar metal forming the basis of potash, which, in fact, is a compound of it and oxygen. This metal Sir Humphrey named potassium. In 1808, the same illustrious chemist succeeded, by the same means, in decomposing the alkali called soda; and the metal he then obtained he called sodium. He afterwards decomposed lithia, lime, barytes, strontian, and several of the substances previously considered as undecomposed earths, by the aid of his galvanic battery; but though he succeeded in showing, by producing an amalgam between the bases of these earths and mercury, that their bases were metals, he can hardly be said to have obtained these metals in sufficient quantity for examination, or have made us acquainted with their properties. In fact, they have such an intense affinity for oxygen, that they instantly combine with it, and and regenerate the earths from which they were obtained. The discoveries of Sir H. Davy were, however, deemed sufficient to authorize the conclusion, that the substances which were previously classed as earths are all metallic oxides, or metals combined with oxygen. Little more is known of the bases of most of these substances than the 1 re fact, that when they are exposed to the action of the galvanic battery, in contact with mercury, an amalgam of that metal is obtained. We shall enumerate the properties of these metals, as far as they have been investigated; but must remind our readers, that they have never been put to any use, and have only been obtained in very small quantities; while their compounds, with oxygen or the alkalies, and earths, are extensively employed in the arts, and form the whole solid materials of the globe. In compliance with the systematic arrangement laid down, we shall at present say no more of these important compounds than may be sufficient to lead our readers to a knowledge of their real or supposed metallic bases. We shall in the present article confine ourselves to the alkalies and alkaline earths.

If wood be burnt to ashes, and these ashes be afterwards washed with water till it comes off free from any taste, and the water be afterwards filtered and evaporated to dryness, the substance which remains is the potash of commerce. When heated to redness, some im-

purities are burnt off, and then it is called pearl-ash. Pure potash is obtained from this, by mixing it with twice its weight of quick lime, and ten times its weight of pure water. The mixture is to be boiled for some hours in a clean iron vessel, or allowed to remain for forty-eight hours in a glass vessel, shaking it occasionally; then pass it through a filter, and boil it in a silver vessel till it is, when cold, as thick as honey. Pour on it a quantity of alcohol, equal in weight to one-third of the pearl-ash, shake the mixture, boil it for a minute or two, and then pour it into a glass vessel, and cork it up. The mixture gradually separates into two portions, the upper of which is pure potash dissolved in alcohol. Decant the solution into a silver basin, and evaporate it rapidly till a crust forms on the surface, and the liquid below will become solid on cooling. Pour it in a porcelain vessel, and, when cold, a white concrete substance is formed, which is pure potash. This is a remarkably acrid and corrosive substance, is employed for a variety of purposes, and was known, at least in its impure state, to the ancient Gauls and Germans.

Soda resembles potash so much, that the two were confounded together up to the year 1736, when Du Hamel proved that soda is the base of common salt, and is different from potash. It is obtained by burning a certain species of plants, called *salsola*, which grows on the sea shore. It is then called *kelp*, or *barilla*, the plant from which it is procured bearing this name in Spain, and is very impure. To obtain it pure, the same process is followed as for obtaining potash. *Lithia* is a caustic substance, which has only been obtained by a few chemists, from subjecting a mineral called petalite, of which it forms a component part, to analysis. *Lime* is well known to our readers; but what is called quick-lime, in common life, is the lime of the chemist. *Barytes* is an earth obtained from the mineral called ponderous spar, or sulphate of barytes, by decomposing the mineral. It resembles lime in its properties, but is of a greyish white colour, is more caustic, and, when taken into the stomach, is a violent poison. *Strontian* is an earth obtained from exposing a mineral, which was first found in the lead-mine of Strontian, in Argyleshire, and hence its name, and subsequently in several other parts of the world, to a violent heat, when mixed with charcoal-powder. The earth thus obtained is of a greyish white colour, having a strong acrid and alkaline taste, and a resemblance to lime. We have already pointed out the mode in which the metallic bases of these several substances were discovered, and we have only now to enumerate their properties, as far as they have been investigated.

Potassium, the metallic base of potash, is white, with a lustre like silver, or mercury; it is lighter than water: at the temperature of 50° it is solid, soft, and may be moulded with the fingers; at 136½° it becomes perfectly fluid; at a heat a little below redness it rises in vapour; at 32° it is hard and brittle; when exposed to the air it absorbs oxygen, and in a short time is covered with a crust of potash, which absorbs moisture rapidly, and is converted into a solution of potash. When heated in oxygen gas to the temperature at which it begins to evaporate, it burns with a brilliant white light, producing intense heat. When thrown on water, it decomposes this fluid, swimming on the surface, and setting fire to the hydrogen gas as it is evolved. On all fluids which contain water or much oxygen, or chlorine, it acts with great readiness, and has such power over other substances, that Sir Humphrey Davy says, it may be compared to the *alkahest*, or universal solvent of the alchymists. *Sodium*, the base of soda, resembles potassium in most of its properties. It is distinguished from potassium, however, by remaining soft at the temperature of 32°, and by requiring a much higher temperature to melt it. It is also somewhat heavier

than potassium, though still lighter than water; and when thrown on this fluid it decomposes it, producing a violent effervescence, but it does not catch fire like potassium. *Lithium*, the base of lithia, is said to resemble sodium; but it must be observed, that some chemists who have made the attempt, did not succeed in obtaining the metallic base of *lithia*. *Calcium*, the base of lime, was obtained in such small quantities, that it has not been investigated. It is said to be heavier than water, to burn brilliantly, and that quick lime is the product of the combustion. *Barium*, the base of barytes, is of a dark grey colour, not so brilliant as cast iron; it effervesces violently in water, and a solution of barytes results. Of *strontium*, the base of strontian, nothing is known; but it has been demonstrated by Sir Humphrey Davy, that the base of strontian is a metal to which he has given this name. The compounds of these metallic bodies which are of importance, such as potash, soda, and lime, will be again brought under the notice of the reader.

ANALYSIS OF THE ASHES OF VESUVIUS. BY M. VAUQUELIN.

These ashes are in very fine dust, (probably from having existed in the volcano in the state of vapour mingled with the vapour of water and with air,) but they contain a few larger particles interspersed.

Their colour is gray, like wood-ashes, whence they, no doubt, derived their name: they have no sensible taste.

A certain quantity of these ashes having been shaken in long glass tubes with water, and the liquor decanted at the end of two minutes, afterwards at the end of four, and so on doubling every time to 16 minutes, we obtained powders of different sizes; but the largest, even seen through the microscope, exhibited nothing recognizable.

Thirty *grammes* of the ashes, shaken with distilled water occasionally for a week, gave to that fluid, after concentration by evaporating, very decided alkaline properties. Evaporating to dryness left some sulphate of lime and muriate of ammonia.

Before the blow-pipe these ashes melt, but not easily, into a very shining black glass, much resembling obsidian, or the glass of volcanoes.

The ashes heated alone in a retort, gave a white sublimate of muriate of ammonia.

Mixed with a quarter of its weight of chlorate of potash, (dry) and heated in a retort, whose beak was dipped under mercury, thirty grammes of the ash gave twenty cubic *centimetres* of carbonic acid. The ash was digested with diluted nitric acid; it swelled, and became gelatinous. After many days of digestion, the acid was further diluted with warm water, poured off clear, and evaporated alone in a porcelain dish. It gave an ill crystallized salt, of a yellowish white colour, with an astringent taste, and slightly deliquescent.

As I supposed this salt to contain nitrate and sulphate of lime, and other non-deliquescent salts, I added strong alcohol, which dissolved one portion and left another unacted upon. In the latter, I found nitrate of potash and sulphate of lime; in the former, the alcohol, which was somewhat watery, had retained, I conjectured, a portion of the nitrate of potash. I therefore first precipitated the alumina and iron by ammonia, then evaporated the liquid, and, when dry, calcined it strongly, to decompose the nitrate and oxalate of ammonia. An alkaline residue remained, which, on saturation with nitric acid, gave nitrate of potash. It is therefore plain, that the ashes of Vesuvius contain a sensible quantity of potash. This alkali is evidently combined in the ashes with silica and alumina, otherwise it would have dissolved by mere digestion with water; besides, this combination is also proved by the gelatinous state produced on digestion with nitric acid.

I proceeded by the usual me-

thods to separate the silica, alumina, and oxide of iron, which are the three principal ingredients in these ashes. The silica composes about 55 per cent, the alumina 15, and the oxide of iron 16.

I also found some slight traces of copper and manganese, but neither gold, copper, nor antimony.

I did not think it worth while to ascertain the proportion of the different elements more exactly, as they no doubt vary considerably at different times of eruption.

CHEMICAL SOCIETY.

By inserting the following letter, we shall show to our Correspondent that we approve of his plan, and are ready to do what lies in our power to promote it.

To the Editor of the Chemist.

Sir,—You must be aware, that the majority of the readers and admirers of your little Work is composed of persons who can devote but a small portion of time to chemistry, and who at the same time are not in circumstances to lock up part of their capital in apparatus, &c. for prosecuting the study of that science; would it then not be advisable for you, who appear so much the encourager of beginners, to form, as it were, a nucleus for a society of young chemists, who might, at their common expense, purchase chemical tests, instruments, &c. as they want them, and that without bringing down ruin on any of them. I should like the society to be respectable and select, and to meet at a stipulated number of times every week.

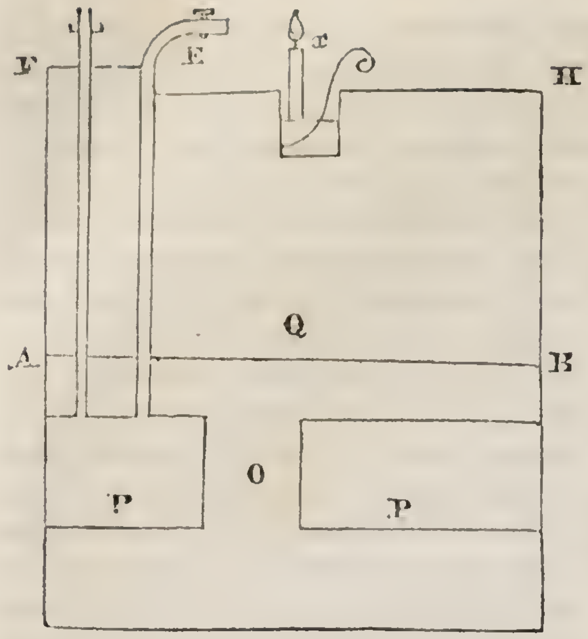
I have the honour to be,
Sir,
Your most obedient,
May 7th. A. W.

CEMENT FOR ROADS.

A discovery has just been made by Mr. G. Gilmore, the surveyor of the turnpike-roads between Durham and Tyne-bridge, which we think will remove every inconvenience now felt from the dust, and be an important improvement on Mr. M'Adam's plan of road-making. This discovery consists in the application of a portion of the oil of salt, which has not only had the effect of completely laying the dust, but it has operated also as a cement, making the pavement at once firm and smooth. Mr. Gilmore has tried his discovery on a part of the turnpike-road near Birtley, when the experiment succeeded to the extent of his wishes. He lately applied a quantity of the oil of salt to that part of Dean-street, which is the only part of Newcastle which has yet been M'Adamized, and the effect has been such as we have described. The dust has been laid much more efficiently than it had previously been by water; besides that it gives the pavement a firm and compact body, while the expense will, in all probability, be less than by an application of water.—*Tyne Mercury.*

THE GUIDING LIGHT OF NATURE.

A Dr. Todd has sent a paper to the Royal Society, which has been read, on the light emitted by the glow-worm and the fire-fly. In the former the light is of a fine topaz yellow colour, with a tinge of green, and is so vivid that within a few inches the hour on a watch may be read. The light of the fire-fly is of a pale yellowish tint, with continual flashes of vivid light. This animal may be seen shining in full moonlight. Dr. Todd supposes the light to be animal light, analogous to animal heat, and separated by the animal, like the heat, from its combinations with matter. He adopts the opinion that the use of this light is to guide the male insects to the female, as the males always approach light. We had at first some doubts as to the purpose for which these lights were given, and thought there might perhaps be some worthy magistrates who look after the worms and exhibit their lanterns, and their "Beware of bad houses," till we remembered that every female is supposed to shine; and as all cannot be vicious even among insects, we concluded it was the guiding light of nature.



DESCRIPTION OF JOHNSON TOFTS'S BLOW-PIPE.

(*From a Correspondent.*)

A GLASS-BLOWER invented an instrument, or chest, into which enough air might be at once blown from the mouth to urge the flame of a common lamp for near five minutes; but the shortness of time during which it continued to propel the air, and the interruption occasioned by having to supply it every five minutes with fresh air, induced Dr. Clarke to lay aside the use of it.

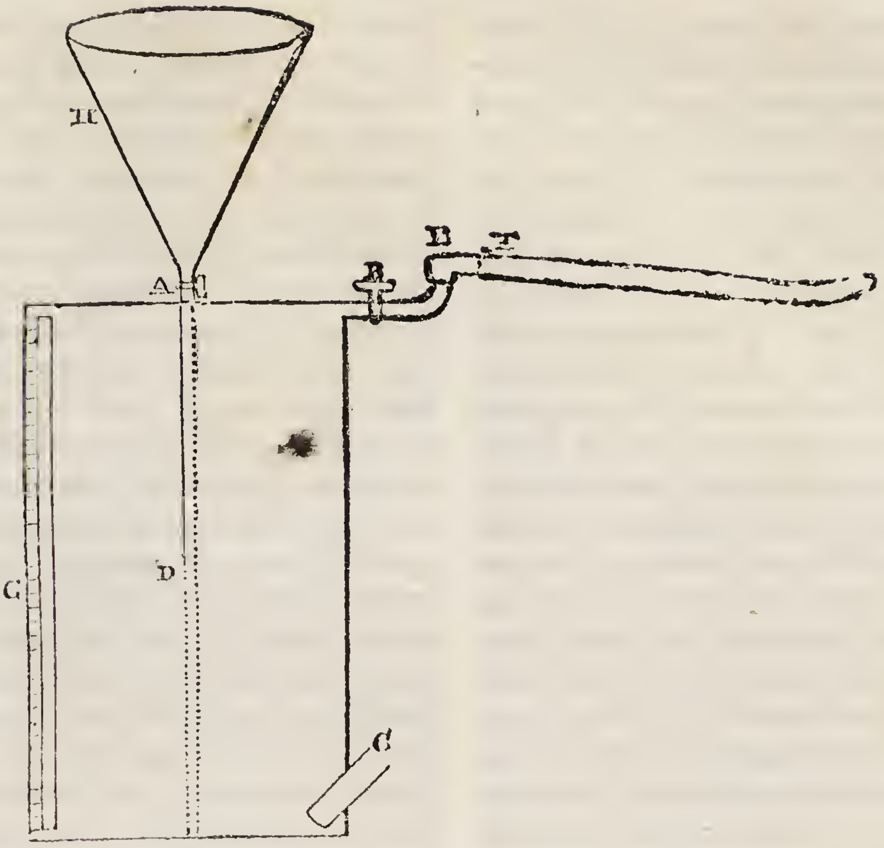
A servant of his, one Johnson Tofts, who often attended at these lectures, took the liberty of asking why his master rejected it; and the cause being explained to him, he, without any help from his master, examined it, and then fell to work and produced an apparatus, which possesses many great advantages over the old construction. This new instrument was two feet high, two feet long, and five inches broad. The cavity was divided into two chambers; the upper one, Q, about thirteen inches deep, and the lower, PP, about eleven. A pipe, O, open at both ends, and two inches in diameter, opens at top into Q, and reaches to within half an inch of the bottom of PP, forming a communication between the two chambers. Two pipes, F and E, arise from the chamber PP, and come out at the top of the chest, each furnished with a stop-cock. The pipe, F, serves to replenish the chamber, PP, with either common air, or any gas, from a bladder or syringe. The pipe E has its orifice bent down to receive jet pipes, for the purpose of propelling the flame of the candle or lamp X; a small opening, H, is left in the top, opposite the pipes F and E.

When this is to be used, some water is first introduced by the pipe F, or the opening H, so as to fill the chamber PP, the pipe O, and cover the bottom of the chamber Q. Common air, or any gas, is next forced through F, into the chamber PP, which forces the water in PP up the pipe O, into the chamber Q, the air in which escapes by the opening H. If the stop-cock of the pipe E be now opened, a jet of air is propelled on the flame by means of the pressure of the water in Q.

The advantages of this instrument are, that the operator has his hands at liberty, and is relieved from the trouble of blowing; and also it possesses advantages which the old instrument did not, viz.—it allows the use of any gas unmixed with common air; it may be kept any time without using it, and may be prepared for use in a moment, by merely lighting the candle or lamp. It is very powerful.

INCANDESCENT TEMPERATURE OF PLATINA WIRE.

M. ERMAN has ascertained the temperature which a platina wire of certain dimensions must have to be incandescent when it is immersed in a current of hydrogen gas. A hollow place in a small mass of iron was filled with mercury, in which was plunged a thermometer and a very fine platina spiral wire; near it was the mouth of a gasometer, supplying at pleasure a current of hydrogen gas. A lamp placed under the iron heated the wire gradually, while its temperature was indicated by the thermometer. He observed with surprise that 41° 7 of Reaumur, or 126° of Fahr. was sufficient to make the platina red hot in the hydrogen gas.—*Annales de Chimie et de Physique,* T. 25, p. 285.



CHEMICAL APPARATUS.

GASOMETERS.

The present plate represents a very convenient gasometer for holding oxygen gas. It is made of tin-plate, well japanned, both withinside and without. It may be of any size: the vessel, of which this is a representation, held about 2000 cubic inches. It is a cylindrical vessel, close on all sides, and ought to be pretty strong, to resist the pressure of the atmosphere, which tends to force out gas, or to force in air, according to the changes in its density which take place. It is furnished with three mouths, A, B, C. The first at the top, the second at the side as high up as possible, the third at the bottom. A and B are each provided with a stop-cock. The stop-cock, at A, belongs to the tube, D, which goes to the very bottom of the vessel into which it is soldered, in order to increase the strength of the air-holder. The tube, D, towards its bottom, is perforated with a number of holes. To the extremity of the stop-cock, B, the piece of bent tube, E, is ground, so as to be air tight, but to move freely round the extremity of B, which is turned up to receive it; and to the extremity of E the long tube, F, is likewise ground, so as to be air tight, yet capable of moving freely. These two tubes, by their motion, form an universal joint, so as to enable the operator to turn the extremity of the tube, F, any way he thinks proper. The mouth, C, consists of a tube about an inch in diameter, introduced into the vessel near the bottom, at an angle of about 45°. It is provided with a stopper, which screws into it and shuts it close. G is a glass tube, fixed into the top and bottom of the air-holder, and graduated. The use of it is to show the operator how much gas the vessel contains.

A few words will explain the method of using this vessel. The first step is to fill it with water. For this the mouth, C, must be shut, and the stop-cocks, A and B opened. Water is then poured into the glass vessel, H, which, running down the tube, D, makes its escape through the holes in its bottom, and fills the vessel, while the common air makes its escape by the stop-cock, B. When the air-holder is quite full of water, the stop-cocks, A and B, are to be shut, the glass vessel, H, removed, and the stopper of the mouth, C, removed. As the vessel is completely air tight, the water cannot make its escape by the mouth, C,

because the angle at which it enters the vessel prevents any common air from entering. The mouth of the tube connected with the apparatus for furnishing oxygen gas being introduced into C, the gas rises gradually to the top of the air-holder, and the water runs out by the mouth, C. When the process is finished, the mouth, C, is to be shut; and if the vessel be a good one, the gas may be kept in it for many months without undergoing much alteration. Suppose we want a portion of the oxygen gas out of this air-holder, for any particular purpose, we have only to introduce the point of the tube, F, into the mouth of the vessel which we mean to contain the oxygen gas, and then to pour a quantity of water into the glass vessel, H, which must be replaced for the purpose. The stopcocks, A and B, being opened, the water runs down the tube, D, and forces the oxygen gas to escape through the tube, F. By this method any quantity of the gas wanted may be easily procured.

THE CULTIVATION OF COTTON.

(*Continued from* p. 160.)

The name of cotton is given generally to a soft downy substance which envelopes the seeds of various plants; but that particular species of this downy substance, which is so extensively employed for making garments, is the produce of a tree or a shrub, of which there are several species known to botanists, under the generic name of *gossypium*. It belongs to the class *monadelphia*, order *polyandria*, and possesses the following characters: Calyx double; exteriorly three cleft. Capsule quadrilocular. Seeds involved in cotton. Botanists enumerate ten species of gossypium, namely—Herbaceum, Indicum, Micranthum, Arboreum, Vitifolium, Hirsutum, Religiosum, Latifolium, Barbadense, Peruvianum. Only a few of these species are cultivated, and principally the herbaceum, arboreum, and the hirsutum. The mode in which it is cultivated depends on the circumstance of the shrub being annual or perennial. In general, the annuals thrive best in a dry, gravelly soil, and are said to prefer old to new ground. The culture begins in the rainy season, about March or April. Holes are made in the ground in rows, at the distance of from seven to eight feet, and a quantity of cotton seed is put into each hole. In a short time the seeds germinate; and as soon as the young plants rise to a height of six or seven inches, they are all, except two or three of the most vigorous, pulled up by the root. The plants allowed to remain are kept pruned down to the height of about four feet, which enables the husbandmen to gather the cotton easily without diminishing its quantity.

On the coasts of Guiana and the Brazils, the perennial cotton is almost exclusively cultivated. The soil, in the former, is chiefly alluvial mud, being deposited by the rivers that there empty themselves into the ocean. The country is so low, that inundations are frequent; and to carry on cultivation of any species, it is necessary to intersect the land with ditches. To plant cotton, the soil is prepared by forming beds of 36 feet in width, slightly elevated in the middle, which are surrounded by drains that carry off the water into the ditches. To take means for keeping the land dry, or at least not to allow water to rest in it, is essential, as stagnant water is peculiarly injurious to the roots of the cotton tree. When the beds are thus prepared, holes are dug about five feet apart in every direction; a little light earth is thrown into every hole, and on that a small handful of cotton seed, and then the earth is raked over the holes. The planting, in general, takes place in showery weather, and in three or four days the young plants rise above the ground. Within a month they attain the height of four or five inches, and all except three or four in each hole are pulled up by the root. The ground is carefully weeded every month, and at the

third weeding, only one plant is left in each hole. When the plants are about eighteen inches high, the tops are cut off to make them put out lateral shoots. The usual period of planting in Guiana is December, January, April, and May; if the planting takes place in the two former months, the tree requires to be pruned in June; if, in the two latter, the plant only requires to be nipped with the fingers, and begins, if the weather be dry, to yield cotton about the month of October. The trees do not however produce a full crop till the second year, and, in general, they last only five years. Wherever a tree fails, its place is supplied; but, there is no regular period of replanting. After the trees are a year old, they are regularly pruned once a year, between April and July. If the season be favourable, the trees begin to blossom about the end of July, or the beginning of August; the pods form in succession; begin to open in about six weeks; and at the end of October, the first picking begins, which is not completed till the end of December. The rainy season then begins, during which the trees vegetate with great vigour, and again blossom. If the weather be fine, a second gathering begins at the end of February, and is completed about the middle of April. In Guiana, however, the second crop frequently fails, owing to a cold northerly wind, which either shakes the blossoms, or the pods fall off; or, if the latter arrive at maturity, the seed and the cotton stick together, and cannot be separated with advantage.

In the West India islands, and in Georgia, the same mode of cultivation is practised; but there, owing to some local peculiarities, the trees are annually renewed. The blue clay soil which is daily forming on the shores of South America, is found to be peculiarly favourable to the growth of cotton; from which circumstance it has been concluded, that salt is a good manure; and accordingly, where it can be done, the land is frequently flooded with salt water, and, it is said, with considerable benefit. Even sandy and gravelly soils, which are situated near the sea, and can be thus flooded, are found to be very productive.

The cotton is all gathered by the hand; and, in general, it is no where cultivated but by a slave population. After the harvest is completed, the cotton is dried in the sun, until the seed becomes quite hard, otherwise it would heat, ferment, and spoil. This takes about three days, during which it is exposed on a wooden or a tiled platform to the rays of a tropical sun. The seed is then separated from the cotton, by passing it through between two slightly grooved wooden rollers, of one quarter of an inch in diameter, which are driven by treadles put into motion by the foot, while the cotton is pressed through by the hand. This machine is called a gin, and a good workman can separate from 50lbs. to 60lbs. a day; but the labour is severe, and the slaves are not kept at it more than a fortnight at one time. Several machines for cleaning cotton have lately been adopted, and are coming into general use, as it is found to be a great saving of labour to prepare it, as far as possible, before transporting it. After it has been ginned, it is carefully picked by women, who free it from broken seeds, dried leaves, and yellow or discoloured locks of cotton. An expert woman cleans from 25lbs. to 30lbs. a day. Some people beat it with switches, which facilitates the cleaning; but as this does an injury to the cotton, it is not generally practised. After the cotton has been thus dried, separated, and cleaned, it is packed up in large bags, into which it is pressed by a screw, and in this state is sent to market. The other processes to which cotton is subjected, till it finally assumes the character of cloth, are all carried on with greater skill in Britain than in any other country. They may all be classed under the heads of preparing the cotton for the spinner, spinning, weaving, bleaching,

and dyeing or printing; and on each of these processes we shall, in a future Article, say a few words. The present article will be closed by some observations on the expense of the cultivation of cotton, and the diseases to which the plant is liable.

Of course the expense of cultivation varies with the situation, and is found to be least in India and America, and greatest in our colonies. In the latter, the capital vested in every acre of land devoted to the cultivation of cotton, including slaves, buildings, &c. amounts on an average to 150*l*. Each acre on an average yields about 200lbs. of cotton; the expense of cultivation alone amounts to 7*d*. per lb.; while the expenses of transport, and other mercantile charges, may be about 7*d*. more. In 1808, the average of the sale prices was 3*s*.; but in other years the prices have been much lower, and, on some occasions, not sufficient to cover the expenses.

The cotton plant is subject to the ravages of a most destructive species of caterpillar, about an inch in length, and of a most beautiful appearance. A very fragrant smell, which may be perceived at the distance of one hundred yards, issues from the plant on which this caterpillar is feeding, though neither the animals nor the leaves of the plant have of themselves any remarkable peculiarity of odour. Another singular circumstance is, that this insect wholly disappears for a season, and then returns, redoubling its ravages, and extending them with rapidity over every field of the plantation. Though it sometimes destroys the whole crop, no effectual remedy for the evil has yet been adopted. Like other plants, also, it is sometimes injured by blights, which are as destructive as the caterpillar.

We cannot conclude this article without remarking, that there is one thing connected with the cultivation of cotton, which, as the prosperity of our country, and the happiness of so many of our people, now depend on this plant, fills us with regret. It is almost wholly the produce of slave labour, and the extension given to the cultivation of cotton has increased the number of slaves. This is only an accidental circumstance, however, arising from the barbarous policy which was formerly pursued in colonizing the islands and continent of the new world, and is not necessarily connected with the cultivation of cotton. It serves, certainly, at present to diminish the pleasure we might feel, were the increasing use of cotton, which seems, on a variety of accounts, deserving of preference as the material for clothing, to occasion an increase in the number of free, rather than of slave cultivators; but we do not despair that this may ultimately be the case, and then there will be no alloy to that benefit which, as we noticed in our last Number, has arisen from the discoveries of Hargreaves, Arkwright, and others.

THE GALVANIC PILE.

(*In answer to a Correspondent.*)

We do not know whether we shall be able, in the compass of this small Article, to give F. E. all the information he requires, because we are quite in the dark as to what he already knows, and to describe the different kinds of galvanic piles and troughs, the mode of using them, and the principles on which they depend, would take up too much of our space at present; we must, therefore, content ourselves with answering his questions. A galvanic pile is thus constructed:—Take a number of pieces of the metal called zinc, say 50, they may be of the size of half a crown, if larger the action is more intense; 50 pieces of copper of the same size, and forty-nine pieces of cloth, somewhat less in diameter than the metals, which have been soaked in a saturated solution of common salt, or in water containing the thirtieth part of its weight of sulphuric, nitric, or muriatic acids, and place these three different substances in the following order:—First, a piece of zinc; second, a piece of copper; and third, a piece of cloth; fourth, a piece of zinc;

fifth, a piece of copper; and sixth, a piece of cloth; and proceed in this way, placing these substances on the top of one another, precisely in the above enumerated order, till the whole are disposed of. You will then have a plate of metal at each end, but at one end will be zinc and the other copper. The pieces of metal may be soldered together, and it is more convenient that they should be; but then care must be taken in placing them, always to lay the same metal undermost. The cloth must not contain so much of the liquid as that any of it will squeeze out by the weight of the plates above. To preserve the pile upright, it may be placed within four rods; or if too high, it may be divided into two or more equal parts, each part being connected both at top and bottom by slips of metal. In this case, however, it is essential that the same order be observed and continued through all the parts, up the first pile, down the second, up the third, and so on. A galvanic pile, constructed in this manner, retains its power for a considerable time, namely, as long as the cloth is moist; and this power is in proportion to the number and size of the plates.

The mode of using this pile is very simple. The shock may be taken, to use our Correspondent's language, by applying the two hands, one to each extremity of the pile; and the shock is felt the instant the second hand grasps the end of the pile. For making chemical experiments, a piece of wire, made of the same metals, is soldered to the outer surface of the plate at each extremity of the pile. Gold or platinum wire answers the same purpose better, because the positive wire of any other metal is speedily oxidated. The two extremities of these wires are then brought nearly into contact, in a glass vessel containing the mixture to be experimented on, or the substance to be decomposed is placed between the two ends of these wires. In *taking shocks* wires may also be used.

We believe we have now given our Correspondent all the information he required. At the same time, we must add, that at present galvanic troughs are much more used than piles. They are made of stoneware, having a number of partitions right across, between which plates of the above metal, soldered together, may be inserted at pleasure, they being all connected together at the top by slips of metal passing from one to the other, the trough containing at the same time a solution of one of the acids mentioned above. Galvanism, as well as electricity, illustrated by Plates, will hereafter be treated of in their proper place, as they form essential and important branches of the science of chemistry.

PROTOIODIDE OF CARBON.

M. Serullas has announced in the Annales de Chimie et de Physique, No. 25, p. 311. that he has discovered a *protoiodide* of carbon, and that it has the following properties:—It is liquid, heavier than sulphuric acid; seen under water it is of an opaque white, which appears to depend on the water: after being agitated in a solution of caustic potass it becomes transparent and of a slight lemon colour; its smell is very penetrating and agreeable; its taste very sweet, very lasting, and accompanied by a sensation of freshness, similar to what is produced by mint. It is soluble in water, to which it communicates in a very marked manner its taste and smell. A solution of chlorine has no action on it, but chlorine in the state of gas rapidly decomposes it. Sulphuric acid has no action on it. When exposed to the air, or placed under water in close vessels, it becomes immediately of a rose colour, which gradually increases in intensity. It does not take fire in contact with a lighted candle. Oxygen saturated with the protoiodide of carbon, either alone or mixed with pure oxygen, does not take fire either by the application of a lighted taper or the passage of the

electrical spark. It is obtained by mixing equal parts of the perchloride of phosphorus with the periodide of carbon, perfectly dry, in a phial with a bent tube, the end of which is plunged in water, kept very cold. The mixture is heated sufficiently to fuse the periodide of carbon, and in a short time vapours of iodine rise; then the protoiodide flows into the tube, of a red colour, whence it passes into the vessel containing water, goes to the bottom, and speedily becomes colourless.

DICTIONARY OF CHEMISTRY.

In compliance with the expressed wish of several of our subscribers, we intend to give in successive Numbers a brief Dictionary of Chemical Terms. Each Number will probably contain ten till the whole is exhausted.

Acetates. In chemistry the term *salts* is usually employed to denote all the compound bodies formed by an *acid* and an *alkali*, a *metallic oxide* or an *earth*, and in this sense *acetates* is the name applied to all the salts formed by a combination of acetic acid with alkalies, earths, or metallic oxides.

Acetic Acid. A peculiar acid obtained from the juices of many plants. This term is also sometimes applied to vinegar, vinegar being in fact a very much diluted and somewhat impure acetic acid.

Acetometer. An instrument for ascertaining the strength of vinegar.

Acids. A large and very important class of bodies. As this word is used by chemists it is much more extensive in its meaning than in common life, and comprehends all substances which have a sour taste, which change vegetable blues to red, and which combine with alkalies, earths, and metallic oxides, forming those compound substances called salts. At present chemists enumerate 87 acids.

Acidifiable. In chemistry this means a capability of being converted into an acid by an

Acidifying Principle. It has been asserted by chemists, that there was but one substance which possessed the power of converting other substances into acids, and oxygen was supposed to be this substance, and was therefore denominated the acidifying principle. At present, however, acids are known in which no oxygen has been, or can be detected; and the acidifying principle is now given up.

Aconita. A poisonous vegetable substance, of an alkaline nature, extracted from the *aconitum napellus*, or wolfsbane.

Adamantine Spar. A remarkably hard stone, which is found in India and China, and is used for polishing gems.

Adepts, among the alchymists, signified those who had discovered the philosopher's stone, but who were not at liberty to reveal the secret.

Adipocere. A curious kind of fat-like substance, somewhat resembling spermaceti, into which animal matters are converted by an incomplete putrefaction.

LUMINOUS BOTTLES.

To the Editor of the Chemist.

Sir,—I have recently seen in your little publication, and in some of the other numerous weekly ones, methods for quickly producing light, &c.; and in a newspaper, Feb. 1824, that "Messrs. Arago and Fresnel have invented a lamp with concentric fires of very brilliant and superior properties," &c; and previous to that, that some foreigners had discovered a method of making a corked bottle luminous by the aid of *factitious air*.

Now, Sir, I wish to know, if there is any method of making a vessel (say a decanter, for instance) luminous when the external air is excluded, or, in other words, when it is corked Or can a decanter be made luminous (of course I mean without any sort of fire) when free admission is afforded to the atmospheric air; and how long in *either* case, and in *both* cases, will they continue luminous without replenishing, &c. The more luminous

the better; and such as not to be destroyed if coming into contact with cold.

Believing, Sir, that many *operative chemists* read your miscellany, I beg you will insert this; and if it produces the *sought for* Article or Articles, on being proved to answer, a compensation will be made through the Publishers (Messrs. Knight and Lacey), to whom the communications also must be made (free of expense), and the sooner the better, addressed to

Cheapside, HENRICUS.
May 10.

PHOSPHORESCENCE OF ACETATE OF LIME.

DISSOLVE any quantity of acetate of lime in water, and place it in a sand bath, in a wedgewood evaporating-dish, and evaporate it to dryness without disturbing it. When quite dry, let the ball of a thermometer be rested on the bottom of the dish, and when the temperature has attained 250° F. the lime will adhere very firmly to the bulb. If light be now excluded, and the acetate strongly rubbed with a stiff spatula, it will become highly luminous.—*Annals of Philosophy*.

CURIOUS EXPERIMENT.

WE mentioned some months ago an experiment exhibited in Professor Leslie's Class-room, in which a hollow brass sphere was balanced on the top of a jet of water, and made to play up and down, in a manner very striking and beautiful. We saw the Professor exhibit subsequently an experiment of the same kind with air, but of a more novel and singular description. Two or three atmospheres of common air were condensed into a close copper vessel, of a size which might be conveniently carried in the hand. A stop-cock, with a very minute aperture, fixed on the top of the vessel, being opened, the condensed air rushes out in a stream. If a wooden ball of the size of a school-boy's marble, or larger, is placed by the hand in this current of air, it is not blown aside or suffered to fall, as we would expect, but continues to leap up and down some inches above the orifice, generally performing at the same time a vertical revolution round its axis. Though the air and water in the two experiments perform the same office, they act in a very different manner. The water, thrown up by pressure, rises in one unbroken filament, of the thickness of a slender rod, to the height of twenty feet or more; but the air being greatly condensed, the moment it escapes from the tube its particles exert a lateral repulsion, and, instead of pouring upwards in a uniform slender stream, it spreads out into the form of an inverted cone, in the axis of which, where the rarefaction is great, the ball plays up and down. So securely is the ball confined by the conical shell of air which invests it, that the vessel may be inclined at an angle of 30 or 40 degrees, or carried about freely in the hand, without the ball falling off. The experiment has, in fact, something of a magical effect; for, when viewed at the distance of three or four yards, so that the whizzing noise of the air is not heard, the ball seems to leap and play, and attach itself to the vessel by some secret and invisible power of its own.—*Scotsman*.

PROCESS FOR RENDERING LEATHER, CANVAS, LINEN, AND OTHER ARTICLES WATER-PROOF.

By MM. Farrimann and Thilly.

TAKE 100lb. of the best linseed oil, add 1½lb. of acetate of lead, 1¼lb. of calcined umber, 1½lb. of white lead, and 1½lb. of very finely-powdered pumice-stone. These solid substances, well ground and mixed together, must be boiled in the oil for ten hours, over a moderate fire, to prevent the oil from burning. This varnish should be of such a consistence, that, when mixed with a third part of its weight of pipe-clay, it will be as thick as treacle. It is left to settle eight days, and is then passed through a lawn sieve. The next process is, to grind,

in a solution of strong and clear glue, as much pipe-clay as amounts in weight to the tenth part of the oil employed, and to mix it to the consistence of ointment; adding the varnish by degrees, and stirring it well with a wooden spatula. This varnish must be repeatedly stirred till it becomes perfectly fluid, and then the desired tint is given by adding a fourth part of the colour, ground in oil.

The linen must be stretched upon a wooden frame, and the composition applied upon it with a large spatula, three inches broad and nine inches long. The frame is then inverted, and the operation repeated upon the other side of the cloth: it is then left to dry for a week, and separated from the frame for use.

This cloth may be used for riding-hoods, covers for carriages, &c. &c.

For leather and skins the same composition is used; but to give the surface a smooth and brilliant appearance, the following varnish is employed:—Take 5lb. of the oil varnish, and an equal weight of well-clarified resin; boil them together until the resin is dissolved; then add 2lb. of oil of turpentine, having the colour to be given to the varnish ground with it, and passed through a lawn sieve. This varnish is to be applied with a brush. When the varnish is thoroughly dry, it must be rubbed even with a pumice-stone and water, and be then washed clean. Two or three coats of varnish being then applied, and each coat suffered to dry for two or three days, is sufficient to produce a brilliancy equal to that of the japan lacker.—*Mechanic's Magazine.*

TO CORRESPONDENTS.

PUBLICUS ARTIUM AMICUS *has been received. His list of errata, as far as it is correct, shall be inserted at the end of the Volume. We have no doubt the two Works he recommends to us as models may be superior to our own; but, unfortunately, one of them is, we believe, dead, and the other dying. Does our* WELL WISHER *wish us to follow this part of their example? His advice would have been still more valuable had the postage been paid; and unless this is done in future, his communications cannot be received.*

J. Williams, E. D . . . y, and W. W. all came to hand too late for insertion, or to be satisfactorily answered in the present Number. They shall all be attended to next week. E. D . . . y is informed, however, that the hints will be attended to; and that we cannot learn when the second Part of the book alluded to is to be published.

Booksellers and Publishers, desiring to have works on Chemistry, or the other sciences connected with it, noticed in THE CHEMIST, *are requested to send copies to our Publishers.*

*** Communications (post-paid) to be addressed to the Editor, at the Publishers'.

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The Chemist.

"——Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

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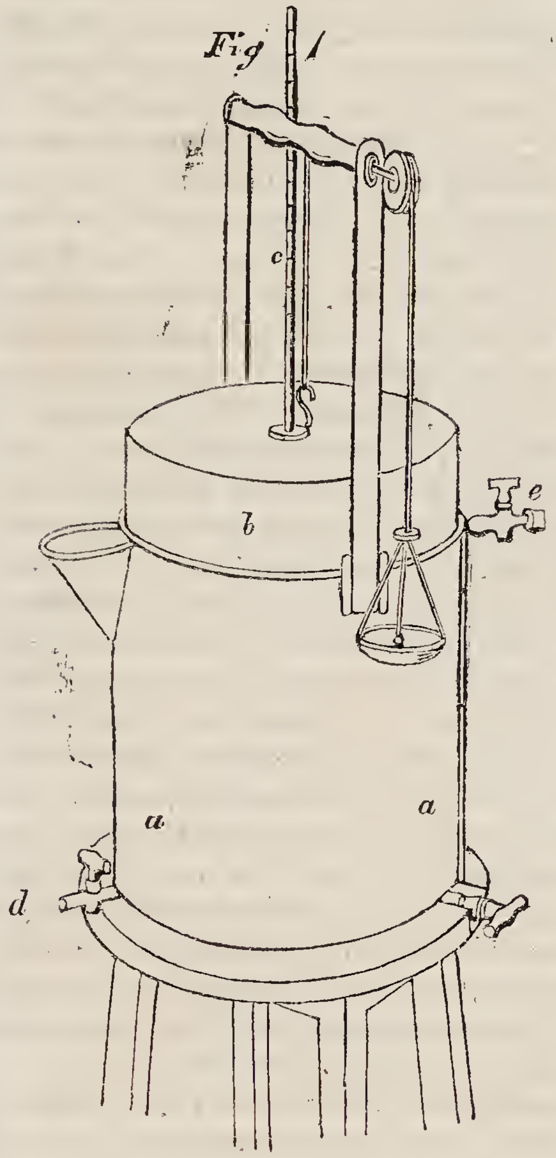
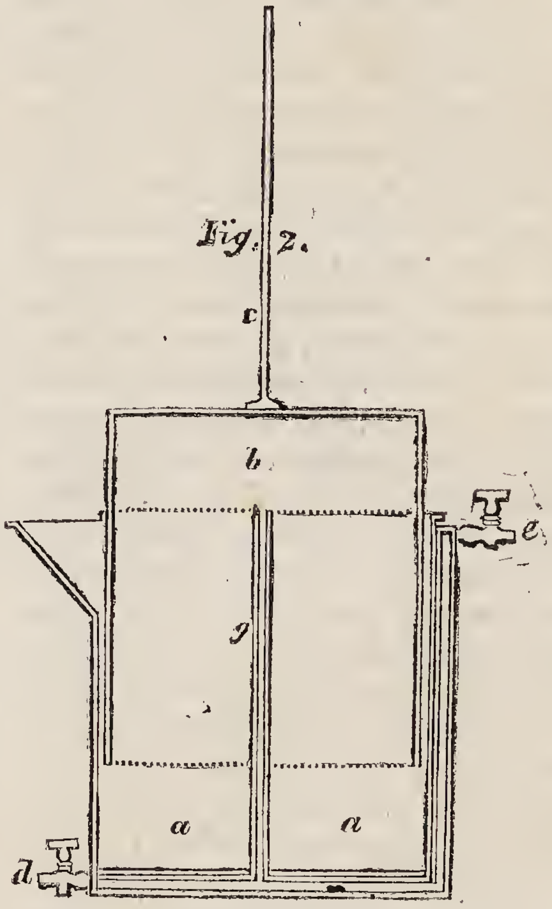




CONTENTS.

CHEMICAL APPARATUS.

Description of the Plate.

Our plate to-day represents a gasometer of somewhat different construction to those we have before given; and there are still others, but which we shall not describe, as they are all on the same principles, though some of them may have a different and, perhaps, a more convenient adaptation. The two figures are different views of the same instrument, the same letters referring to both. Like the other, this is made of japanned tin: *a a* is the outer vessel with a spout at top; *d* and *e* are two tubes firmly soldered to the side of the pail, each of them having a stop-cock; *d* penetrates at the bottom of the vessel, and proceeds to the centre, where it joins *e*, which enters from the top, and proceeds downwards; the place of junction, the upright tube, *g*, rises through the middle of the pail a little above the upper rim; *b* is a cylinder, open only at the bottom, and of less diameter than the vessel, *a a*, in which it moves up and down freely; *c* is a solid stem, which passes from it through the hole in the wooden cross bar of the frame, and serves both to indicate the quantity of gas in the vessel, it being graduated, and to keep the cylinder in a perpendicular direction. There is a scale-dish connected with the top of the cylinder by a cord and pulley, and weights put into this dish serve to balance the weight of the cylinder. There is an opening at *f*, which has a stop-cock, where the water may be drawn off. To use this gasometer, let the cylinder fall to the bottom of the outer vessel, and pour water into the latter till it is quite full; then shut the cock, *e*, open *d*, and connect it with the vessel supplying the gas; though, if it be more convenient, *d* may be shut, and *e* opened. The gas rises through *g* to the top of the cylinder, *b*, which it gradually lifts up, care being taken to have weights in the scale-dish to enable it to rise easily. When the supply is complete, shut the stop-cock, and the gas may be kept till wanted. To take away gas, connect a bent tube with one of the stop-cocks, insert the mouth of it in the vessel which is to receive the gas, open the cock, take the weights out of the scale, and the weight of the cylinder, *b*, will press out as much gas as is wanted. As the cylinder rises, weight must be continually added to the scale, otherwise the gas would be more and more compressed, and would at last cease to enter.

SKELETON OF A MAMMOTH.

The entire skeleton of a large mammoth, or fossil elephant, of the same species as those found in Siberia and in various parts of Europe, has been recently discovered at Ilford, Essex, near Stratford and Bow. It lay buried 16 feet in a large quarry of diluvial loam and clay, which is digging up for making bricks. Mr. Gibson, of Stratford, has been diligent in collecting the bones of this skeleton, and a few days back Professor Buckland and Mr. Clift assisted him in digging up the bones, which he had purposely left in the first discovered position. These gentlemen found a large tusk and several of the largest cylindrical bones of the legs, many ribs and vertebræ, with the smaller bones of the feet and tail lying close to one another, making, with those before found by Mr. Gibson, very nearly an entire skeleton, fifteen feet high. They were embedded in tenacious clay, being part of that great superficial covering of diluvial clay, sand, and gravel, which is spread over a large portion of Essex, Suffolk, and Norfolk, and along the whole east coast of England at intervals, and in which has been frequently found remains of antediluvial animals.

WATER SPRINGS.

Where the snow melts first in spring, where no dew lies in summer and no frost glitters in autumn, and where no plants but short grasses grow, while the rest of the field bears a good crop, there you may expect concealed beneath the surface a spring of water.

CHEMISTRY AS A SCIENCE.

Art. XII.

METALS FORMING, WITH OXYGEN, EARTHY AND NOT ACID SUBSTANCES.

PERHAPS we should have placed magnesium, the first article to be treated of in the present paper, in the last; but magnesia, the earthy compound of magnesium and oxygen, is so innocuous compared with lime, and has so much more resemblance to earth than to the acid alkalies, that we thought the single circumstance of its changing very delicate blues to green, did not authorize us to place it among them. Magnesia is probably known to most of our readers, as it is a very common medicine. It exists, combined with sulphuric acid, and is then called sulphat of magnesia, in salt water, and in many springs, particularly in some about Epsom, whence sulphate of magnesia has been named Epsom salts. If this salt be dissolved in water, and half its weight of potash be added, the magnesia is immediately precipitated. It is to be washed with water, and dried and exposed to a red heat. In shops, what is called magnesia is a carbonate of magnesia, and calcined magnesia is the earth in a pure state. Magnesia is usually procured on a large scale by acting on magnesian limestone with what is called bittern, or spirit of salt, it being the uncrystallized residuum, after all the common salt has been made. This is an impure muriate of magnesia, and being mixed with the magnesian limestone, the acid combines with the lime, forming a soluble salt, and leaves behind the magnesia both of the stone and the bittern. Or a crude subcarbonate of ammonia is obtained by distilling bones in iron cylinders: with this the bittern is decomposed, and muriat of ammonia and subcarbonate of magnesia result. The former is evaporated to dryness, mixed with chalk, and sublimed, by which subcarbonate of ammonia is recovered, to be again employed in decomposing a new quantity of bittern.

Magnesia is a white soft powder, having very little taste, and no smell. This was considered up to the time when Sir Humphrey Davy discovered the metallic base of potassium, as a simple undecompounded substance; from that discovery he was led to suppose that all the earths had some metallic base, and at length he succeeded in decomposing magnesia. Sulphate of magnesia was moistened and exposed to the action of a galvanic battery, in contact with mercury, the earth was reduced, and its base amalgamated with the mercury. It was found to be a white solid metal, looking like silver, and being considerably heavier than water. When exposed to the air it absorbed oxygen, and was converted into magnesia. To this metal Sir Humphrey Davy gave the name of magnesium, and since then magnesia has been classed as a compound substance, and the metal *magnesium* as a simple elementary substance. Nothing more than this is known of magnesium. When it is combined with 40 parts in the 100, constituting magnesia, it forms a very considerable portion of the stony crust of the globe; and a large portion of all the matters held in solution by its different waters, is magnesia in combination with some acid.

Yttria is an earth, like magnesia, but it has only been obtained by subjecting two minerals, both of which are found in Sweden, to an elaborate chemical analysis; and it has been made only probable that yttria, like magnesia, has a metallic base, but whether the same or a different metal is not ascertained.

From the beryl, a transparent green stone of considerable hardness, called also aqua marina, and from the emerald, a white powder is obtained by a long process, which is called *glucina*. It has been supposed that this earth is a metal combined with oxygen, and to this metal the name of *glucinum* has been given. Neither the earth nor the metal has ever been put to any use, and no further knowledge of the least value has ever been acquired of either of them.

Alum is a substance which is probably known to our readers, and has been used for various domestic purposes for many centuries. If this substance be dissolved in water, and ammonia be added to the solution, a precipitate falls down, which, having the fluid poured off it, and being washed in water, is *alumina*. Still it contains, however, a quantity of sulphuric acid, with which it was combined, forming the alum, and this must be driven off by exposing it to a strong heat in a platinum crucible. The earth thus obtained, or alumina, has little taste, and, when pure, no smell; if it contains oxide of iron, however, which it very frequently does, it has that peculiar smell which is called earthy. At first this earth, being known to constitute the plastic principle of clays and loams, was called argil, or argillaceous earth; but subsequently, being obtained in the greatest purity from alum, it was called alumina. It was considered an elementary earth till Sir Humphrey Davy's researches led to the conjecture, that, like barytes and lime, it was a metallic oxide. This conjecture has, in some measure, been verified by some experiments of this chemist, but nothing is known of the properties of the metal which forms the base of alumina. It has, however, been named *aluminum*, and is considered, with no very good reason, we think, a peculiar elementary substance. It has never been obtained in a separate state, and of course has been put to no use; but the earth alumina is widely diffused through nature, and is extensively employed in the arts. It constitutes a large portion of all clays, and, together with silica, another earth, is the principal ingredient in all porcelain and earthenware. Bricks and crucibles are also made chiefly of alumina. Fullers'-earth, ochres, pipe-clays, are all composed principally of alumina, and derive their valuable properties from it. It is used both in dyeing and scouring, and, as will be seen in another part of our journal, may be employed to bleach sugars, as well as woollen cloth. Almost all soils, certainly all good soils, contain a considerable quantity of alumina, and derive from it their property of retaining moisture, which is so necessary to the nourishment of plants. Many rocks and minerals consist principally of alumina. It forms also the basis of several gems or precious stones; and as the diamond is crystallized carbon, so the sapphire and the ruby consist, in a great measure, of pure alumina in a state of crystallization.

As alumina is the basis of clays, and constitutes the retentive principle of soils, so *silica* is the chief ingredient in all sands, and may be considered as the filtering principle of all soils. When these earths are mixed together in proper proportions, the soil is neither too retentive of moisture, nor does it part with it too easily; and certainly no soil is good in which both these earths are not met with. Silica, like alumina, is also found crystallized in many parts of the world, and is called rock crystal, a substance resembling regular masses of glass, with which probably most of our readers are acquainted. Silica may be obtained pure by mixing one part of pounded flint or quartz and three parts of potash, and heating the mixture in a silver crucible till it is quite melted. The fused mass is to be dissolved in water; add to the solution as much acid as will saturate the potash, and evaporate to dryness. A white mass remains behind, which, after being washed with plenty of water, is silica in a state of purity. It is a fine white powder, without either taste or smell, with a harsh feel, as if consisting of grains of very fine sand. It may be exposed to a very intense heat without undergoing alteration; but some chemists have fused a small quantity of it. By passing the vapour of potassium over silica in an ignited state, Sir H. Davy obtained a dark-coloured powder, which he concluded was formed with *silicon*, the supposed base of the

earth silica. There is no other reason, except analogy, for believing that the earth silica is a metallic oxide, having for its base the peculiar undecompounded metal *silicon.*

Zirconia, like silica and alumina, is a primitive earth, but, unlike them, they being widely diffused through the globe, it has been found only in two precious stones, the zircon and the hyacinth, both of which come from the island of Ceylon, though some of the latter are found in other parts of the world. By mixing these stones, reduced to powder, with potash, and heating the mixture, as was mentioned of silica, zirconia is obtained, which possesses many of the characteristics of silica. The two precious stones from which it is obtained are found to consist of it and silica, with a small quantity of iron and nickel in a state of crystallization. Sir H. Davy subjected zirconia, as he did silica, to the test of potassium vapour, and there is the same evidence to conclude zirconia to be a metallic oxide, compounded of a metal, to which the name of *zirconium* has been given, as there is to conclude silica to be a metallic oxide. It is probable that both are metallic oxides, but not so probable that each has a different metal for its base.

Thorina is an earth obtained from only one or two minerals, and resembles zirconia. The earth has been put to no use; and it is a mere supposition that it has a metallic base to which the name of *thorinum* has been given. We have perhaps detained our readers rather longer than we ought with this part of our subject; but in doing so we were guided by a wish to make them acquainted with the present state of the science, and shall pass over the remainder of the uninteresting portion of the undecompounded substances with a very slight notice. Among them, however, are those metals of which so much use is made in the arts, and on these we shall bestow a larger space. Iron will be the subject of our next article.

ON THE PREPARATION OF THE OXIDE OF URANIUM.

By Messrs. Lecanu and Serbat.

THE authors of this process, after having fused the pulverized mineral (pechblende) with half its weight of nitre, washed the mass which results from the operation, and heated the residuum with nitric acid; evaporated the solution to dryness, and re-dissolved in water acidulated with the same acid; they then added to the solution excess of carbonate of ammonia, which, while it is sufficient to re-dissolve the whole of the oxide of uranium, has no action on the carbonates of lead and lime. Mr. Laugier, in commenting on the above process, recommends the use of 1½ parts of nitre instead of half a part. The solution containing the nitrate of ammonia and the carbonate of uranium is to be evaporated to a dry mass, and calcined to obtain the pure oxide. Mr. Laugier advises in preference, to wash away with hot water the nitrate of ammonia, and to calcine the remaining carbonate of uranium, which has in the filter a fine lemon yellow colour.—*Journal de Pharmacie.*

SUGAR BLEACHED BY CLAY.

M. PAJOT DES CHARMES, whose name has before appeared in our journal as the discoverer of a mode of bleaching sugar by chlorine, has more lately announced that pure alumina may be used very advantageously for the same purpose. To take away completely the colour of a cold solution of sugar of a course quality, he found it was only necessary to agitate this solution for a few minutes with the tenth part of its weight of pure alumina, mix it, after decantation, with a tenth part of its weight of animal black, and then subject it to agitation a second time, with half the quantity of pure alumina before used. This mode of managing the sugar, which is done without fire, and does not require the strainer to be used, is speedily and easily effected, and is very economical. The common coloured clays of the neighbourhood of Paris

may be employed to obtain the alumina, if the salts extracted from it are turned to account. Alumina is easily recovered after the operation, by the action of liquid chlorine, or by that of the regulated heat of a reverberatory furnace. The author adds, that clay powdered, sifted, and subjected to a slight degree of calcination, produces, in that state, a considerable effect. Other coloured syrups may be advantageously bleached by the same method.

PRUSSIATE OF AMMONIA AND IRON.

(*From a Correspondent.*)

Pour into a phial of the capacity of six ounces, three ounces of caustic ammonia upon half an ounce of the finest and purest Prussian blue, reduced to a fine powder. Stop the phial well, and leave the mixture to macerate in the cold for several days, taking care to shake it from time to time. If the deposited matter is become brown, add a new quantity of blue, and repeat this addition until the colour no longer changes. Filter the matter through paper, and pour, by little and little, on the residuum, an ounce of water, in order to separate all the salt. The filtered liquor is prussiate of ammonia and iron; it has a beautiful yellow colour, and a particular odour.

HEATING POWER OF COKE AND WOOD.

Some experiments have lately been made at Paris, where wood is consumed in immense quantities, and is very dear, on the different heating powers of it and coke. The following was the result:—In the Opera House of that capital there are two stoves, placed in two precisely similar situations; one of these stoves was heated with wood, the other with coke. A thermometer was placed near each stove, so as to show the temperature the air acquired. The temperature of the atmosphere was 41°, and that of the air in the neighbourhood of both stoves 52° when the fire was first made in them. The fire was kept up in both for five hours, and the average temperature during this time was, of the air in the room of the stove heated by wood, 62°, of the other, 68°, so that the heating effect of the coke was nearly double that of the wood. There were employed about 160lbs. of wood, which cost 3 francs, 10 centimes, and about 68lbs. of coke, which cost 1 franc, 80 centimes, and about 14lbs. of this remained, and might be afterwards burnt, while the whole of the wood was consumed. By employing a quantity of coke, therefore, which did not cost half so much money as the wood cost, nearly double the quantity of heat was obtained. As in most parts of England the difference of price between coke and wood is greater than in Paris, it should be proportionately more advantageous to burn the former than the latter.

HISTORY OF SYMPATHETIC INKS.

"Heaven (says Pope) first taught letters for some wretch's aid,
Some banish'd lover, or some captive maid."

And so, on the authority of history, we can assert, Heaven, for much the same purpose, taught man, or rather maidens, the use of sympathetic ink. As long ago as the days of Ovid, we find him recommending the girls who wished to write secret love-letters, to use fresh milk, and the dried writing could be made visible by ashes or by rust. It is quite plain, that any colourless fluid, which is a little sticky when dry, would answer the purpose as well as milk. This is, however, a mechanical sympathetic ink, and hardly falls within the notice of the chemist. Pliny, who was more knowing in such matters than Ovid, though less disposed, it is thought, to put his knowledge into practice, recommended that the milky juice of certain plants should be used for writing such letters. In modern times, the juice of many such plants is known, but in use it is super-

seded by chemical liquids. A sympathetic ink, which was to show itself at a distance, was known to an apothecary of the name of Brossonius, as early as 1653. He taught the use of it to Borel, under the name of a magnetic fluid, which was to be visible only when looked on by the eyes of affection. To this ink, made of arseniated liver of sulphur, he ascribed the property of shining through many folds of paper, and even through a deal board. The German author who tells this, explains the mode in which this ink worked as follows: Sulphur is so strong that if a person writes with acetate of lead on one side of 24 sheets of paper, and exposes the other side of the 24 sheets to the vapour of arseniated sulphur, the vapour penetrates through all the sheets of paper, and makes the letters on the other side visible, and nearly black. If a strong acid is added, the effect is increased, and even a thick deal board may thus be written on one side, and the letters made visible by the application of sulphur to the other. The first person who has left in modern times any record of sympathetic magnetic ink, was Peter Borell, who wrote about 1653; and in 1669 the magnetic power of this ink was denied, and its mode of operation shown by Otto Tachen, a German chemist. Waiz showed, in 1715, how to prepare sympathetic ink from the metal called cobalt; though before that the secret of preparing green inks was known, for Paracelsus is said to have known how, by their means, to produce in winter the appearance of a garden. Since that time the knowledge of sympathetic inks has never been lost to the world; but the Post seems so convenient a mode of conveying the secrets of lovers, without any fear of their meeting the jealous eyes of guardians or keepers, that black ink is almost the only one in general use.

PERFUMED SWORDS.

We do not think it can be any pleasanter to die by a sweet scented weapon than by one which has only the qualities of steel. There may, however, be dandies in armour as well as in dress, and to them we recommend the following method of making perfumed sword-blades:—Take eight grains of ambergris, and four grains of musk, grind them together with a little sugar-candy in a glass or an agate mortar; add to the mixture four scruples of oil of Benjamin, and mix it well together. Then hold the sword-blade over a gentle, clear charcoal fire, and when the blade is well heated, dip a little sponge in the mixture, and wipe the sword all over with it. Though this should be done only once, yet will the blade for ever retain the odoriferous scent.

RANCID BUTTER.

To the Editor of the Chemist.

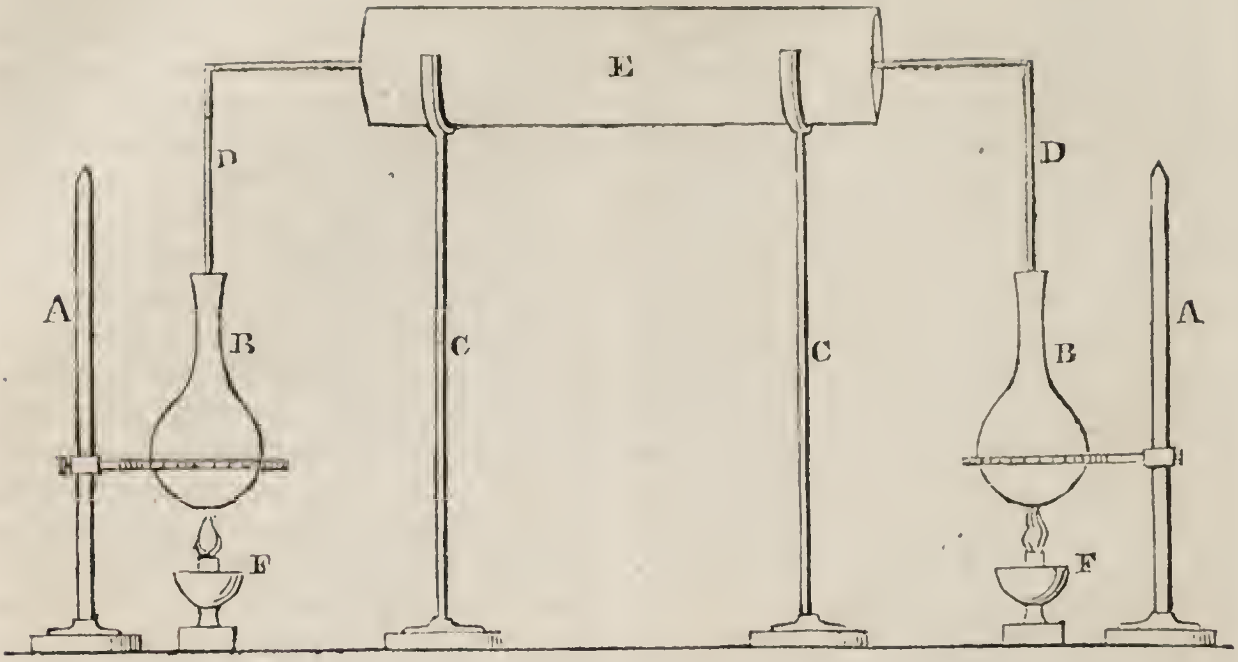
Sir,—As I believe in the old adage, that to prevent is better than to cure, I subjoin a mode of preserving butter free from rancidity for a great length of time:—Take two parts of good dry salt, one part of good Lisbon sugar, and one of nitre: mix them. To every pound of good fresh butter add one ounce of the above mixture, work it well together, and press it into jars for use. It should be kept three weeks before used; if it be sooner opened, the salts will not be sufficiently blended with it.

Your obedient servant,

Richmond. A Dairymaid.

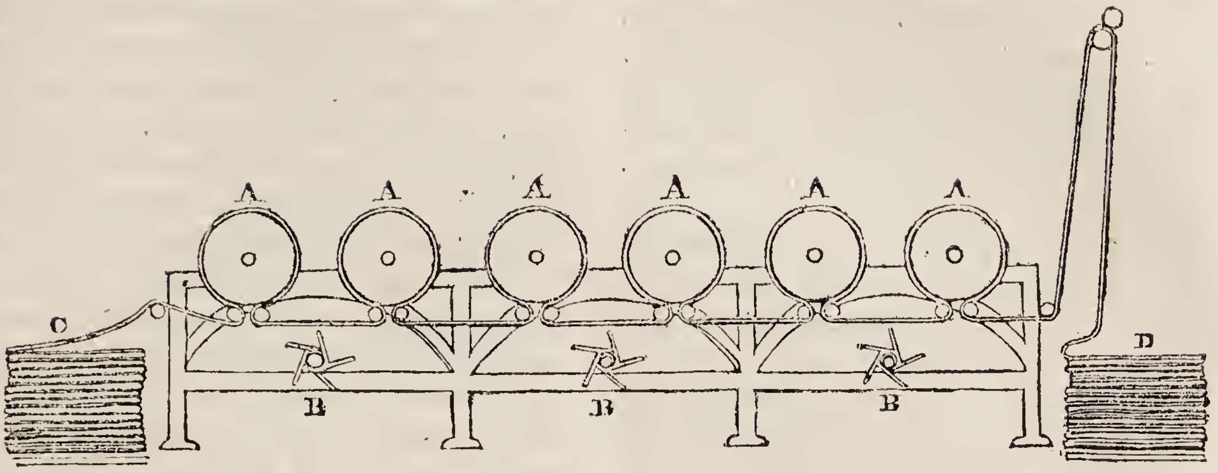
TEST FOR COPPER IN SWEETMEATS.

It is said to be a practice among confectioners to colour their comfits by means of copper; and lately, a gentleman published a letter in one of the public papers, mentioning that one of his children and a nurse had been made unwell by eating such comfits. To detect the presence of copper, pour over the comfits liquid ammonia, (hartshorn) which, if copper be present, speedily acquires a blue colour.



TO MAKE A SOLID OUT OF TWO INVISIBLE GASES.

Our little plate shows the mode of making a very pleasing and instructive experiment. Sal ammoniac, or muriate of ammonia, a salt generally known, is a compound of muriatic acid and volatile alkali. Both these substances exist in a gaseous form, and are invisible, like common air; but both may be combined with water, which acquires their properties, by reducing them to the liquid state. If these two substances are brought, in their gaseous and invisible state, into contact, they instantly unite to form sal ammoniac, which is a solid substance, and is usually met with in the form of a hard elastic cake. To ignorant persons this may appear something like a creation; for nothing is seen, nothing can be felt, and yet a solid matter is produced. The smell, indeed, the taste, and the deleterious effects of the gases, if breathed, and the knowledge we possess of air and its properties, though it also is invisible and unfelt, except when the storm rages, convince us that the gases are substances as well as the solid; but to those who did not know these things, the experimenter might assume the character of divinity, and man might lay claim to the powers of creation. To make this experiment, take two glass flasks, B B, placed in brass flask-holders, which may be moved and fixed to any part of the upright stands, AA. Pour into one flask muriatic acid, and into the other liquid ammonia; connect the two flasks by means of two tubes, D D, bent at right angles, with the glass hollow cylinder, E. These tubes must enter both E and the flasks, B B, and be fitted air tight to both. The glass E is supported by two stands, C C. Apply the heat of two spirit lamps, F F, to the two flasks, and the ammoniacal and muriatic acid gases, rising in the form of invisible vapours by the action of heat, and meeting in the glass cylinder, E, form first a white flaky cloud and afterwards a dense mass, which soon renders the glass opaque and the further progress of the experiment invisible. If, however, it be continued, there will be found, when the experiment is completed, a white solid substance deposited on the inside of the glass cylinder, which is muriate of ammonia. This experiment is instructive, as showing in a clear manner the change of form which sometimes results from chemical action.



THE MANUFACTURE OF COTTON.

(*Continued from* p. 172.)

THE first thing which is done with the cotton after it is brought to England, is to pick it; and in many places this is still done by the hand, as most of the machines which have been employed for this purpose have been found to injure the staple of the cotton. When picked or cleaned by the hand, the cotton is laid on a table made of cords, and quite elastic, and it is then beaten with slender rods. This separates the fibres without breaking them, and the seeds fall through between the meshes of the cords. Some of the machines which have been constructed to save this labour, are in imitation of it, and are called batting-machines; others are called roller-gins; and others again, which seem to have answered best, centrifugal cotton-pickers. These machines are too complicated for description, and we shall, therefore, pass to carding. This is conducted on the same principle for cotton as for other similar substances; and it is probable that most of our readers are acquainted with the process. The card is a kind of brush made of wire, and was originally used by the hand; afterwards cards were fixed; and now they are all cylinders, driven by steam or water. In the process of carding there has been a prodigious saving of labour, by the introduction of machinery. After the carding, the cotton is stretched, or, as some people call it, roved, which is a species of imperfect spinning, as it at the same time receives a small twist. After the roving is complete the cotton is wound on bobbins, and is then ready to be spun, which it now is, by what is called the water method, invented by Sir Richard Arkwright, or by means of what is called a mule, the invention of Mr. Crompton,--Jennies, which were the invention of Hargreaves, having given place to these two still more efficacious methods. It is in spinning that the improvement in the mode of manufacturing cotton has been greatest. There is not only a much greater quantity of work done by the machinery than could possibly be done by hand; but the size of the yarn has been more varied, and it has been made finer and more regular than the unassisted hand could possibly have made it. A single pound of fine cotton has been spun by a mule into 350 hanks, each hank measuring 840 yards, and forming, when united, a thread 167 miles in length. Weaving is also now extensively carried on by means of what is called power-looms, or looms set in motion by machinery, so that every step of the process is now done by means of machines. It is however remarkable, although these machines have in a great variety of cases supplied the place of the hand, and have produced a much greater quantity of cotton cloth than could have been produced by mere manual labour, yet the demand for cotton cloth and the consumption have gone on so rapidly increasing, that double the number of hands are now required to attend these machines and make

them, than were employed altogether in the cotton trade fifty years ago. So that it is quite evident, though the introduction of machines may change the nature of employment, it does not diminish its quantity.

The following account of the labour vested in one pound of cotton, which is taken from the Monthly Magazine, will serve to give our readers some idea of the quantity of persons employed in preparing cotton for the market, and the increased value their labour gives it. Some cotton wool was brought from the East Indies to London, and went from there to Manchester, where it was cleaned and spun. From Manchester it was sent to Paisley, where it was woven, and thence it was sent to the town of Ayr, where it was tamboured. It went back to Paisley, and was veined; and was then sent to Dumbarton, where it was hand sewed, and was afterwards returned to Paisley. It was sent to Renfrew to be bleached, returned again to Paisley, whence it went to Glasgow and was finished, and from Glasgow was sent by the coach to London. The time occupied in bringing this article to market, from the time of its being packed in India, was three years; and it must have been conveyed 5000 miles by sea, and 900 by land; it contributed to the support of not less than 150 people, and its value was enhanced, probably, more than a hundred fold.

We have already, in some of our preceding Numbers, described bleaching at length, which, together with printing and dyeing, are the only parts of the cotton manufacture which can be called chemical arts, or which can be explained on chemical principles. The cleaning, spinning, and weaving of cotton, are all mechanical arts; and for this reason we have thought it right to pass them cursorily by, that we may treat more at length of that part of the subject which belongs to chemistry, we mean dyeing and calico printing. Dyeing is a very ancient art, as we learn from the sacred writings; for there were *scarlet* threads in the days of Judah, and the midwife used one to mark Tamar's child. There can be no doubt that, at the same period, or more than three thousand years ago, the Egyptians,--who perhaps taught the art to the Jews, and learnt it themselves from the inhabitants of India, who preceded them in the acquisition of knowledge,—practised it with singular success. Thus, at the present day, there are two principal modes of dyeing; one of which consists in the direct application to the cloth of the colouring matter, in the other, the colouring matter can only be applied through the medium of another substance, called techinally a mordant; and this last, which is the more difficult of discovery, and more extensively applied, was known to the Egyptians. Pliny says of them, that they began by painting or drawing on white cloth with drugs, which in themselves possessed no colour, but had the property of attracting or absorbing colouring matters. After which, these cloths were immersed in a heated dyeing liquor; and though they were colourless before, and though this dyeing liquor was of one uniform colour, yet, when taken out of it, soon afterwards they were found to be wonderfully tinged of different colours, according to the peculiar nature of the several drugs which had been applied to their respective parts, and these colours could not be afterwards discharged by washing.

The Jews were not the only nation which borrowed its arts from the Egyptians. The Tyrians and the Greeks both adopted numerous arts from them, and the former, improving on what they borrowed, became the inventors of that dye known in all antiquity by the name of the Tyrian purple. So beautiful was this colour, that the Roman Emperors, when they became masters of the world, confined the use of purple to themselves, and forbad, on pain of death, any other person to wear it, even though it should be covered with vestments

of another colour. It thus became associated with all the monstrous vices by which those persons made themselves infamous, and the sacred purple must have been the abhorrence of mankind. The practice of allowing nobody to wear this cloth, limited the number of manufacturers, and by the time the Roman empire was extinct, the art of dyeing purple was lost to the world. It was even supposed, for a long period, that such an art had never really existed, and that the accounts handed down on the subject were wholly fabulous; but the art has been recovered in modern times, and though not used, because better processes and better colours have been found out, it has been clearly shown that the shell fish, a species of whilks, from which the ancients obtained this dye, yet exist in abundance in several parts of the world, and still furnish a white liquor, which, when exposed to the light, becomes first green, then blue, then red, and in a few minutes a beautiful purple. Our ancestors, the Germans and ancient Britons, were not ignorant of the art of dyeing, and perhaps the discovery of the valuable properties of woad for this purpose was owing to them.

At present, dyers distinguish the colours they employ into two species, and call those which of themselves produce permanent dyes, such as *indigo*, *woad*, and different metallic solutions of *iron*, *gold*, *cobalt*, *platinum*, and *silver*, substantive colours; while those which only give dyes by the instrumentality of mordants, are called *adjective* colours. In dyeing cloths with the former, little more is necessary than, after they are well cleaned, to immerse them in a solution of the colouring matter. In using the latter, the mordants must first be applied. The principal mordants in use in Great Britain are acetate of iron, acetate of alumina, and various solutions of tin. When piece goods are to be dyed of one uniform *adjective* colour, they are immersed in a solution of one of these mordants, and are then exposed to dry. During the drying, the substance used having an affinity for the oxygen of the atmosphere, generally absorbs a considerable quantity. That part of the mordant which has not chemically combined with the cloth, is afterwards removed by washing, or by steeping the cloth in water mixed with cow-dung, which is extensively employed for this purpose. It is afterwards passed through a solution of the colouring matter which it is to receive. When a piece is to be dyed of different colours, the mordant for each colour is only applied to the particular place, so that the colour is fixed only in that spot. The cloth is, indeed, wholly coloured, but the colouring is easily removed from the parts to which the mordant was not applied, by exposure to the atmosphere. Although it is plain that the mordants, both in combining with the cloth in the first instance, in afterwards combining with the oxygen of the atmosphere, and with the colouring matter, act by chemical laws, yet the combinations of the mordants with the colours are different, as the substance dyed is wool, silk, linen, or cotton. In many cases this difference of action has been referred to its right source; and, perhaps, no modern art has been more than dyeing indebted to chemistry. Almost all the metallic colours, and which are at present the chief colouring matters, have been discovered by the chemist, and by him applied to the art of dyeing. Numerous researches, too, have been made on the nature and effects of the colouring matters; but still the whole is much better practically known than theoretically explained. We shall, therefore, only observe on this part of the subject, that the great object is to find out colouring substances, the brighter the better, which have little or no affinity with any other substance but the chemical mordant; and although it cannot be expected that this should ever be fully realized, yet the nearer we approach to it, the greater will be our improvement in the art of calico printing.

After the cloth has been dressed, or had the nap singed off by hot iron,—or, as is now the practice at some manufactories at Manchester, by the action of passing over it a stream of burning gas,—cleaned by being exposed to the action of some caustic solution, soured, as we have described under "Bleaching," and calendered by being passed through a set of rollers, it is fit for printing. The piece of calico is then laid on a strong wooden table, covered with a woollen cloth. One or more mordants, as the case may require, is applied by means of wooden blocks, with the patterns cut in them, or formed by means of pieces of brass or copper applied to them. For printing, the mordant is mixed with flour paste, or thick solution of gum, and is then applied to a piece of superfine woollen cloth, stretched tight on a hoop, which is placed within another hoop covered with sheep-skin or oilcloth. The former is called a sieve, the latter a case, and they are placed together in a tub of gum-water. The mordant is then applied by means of a brush to the woollen cloth. If a colourless mordant is used, the workman makes it visible by the addition of some fugitive colour, in order that he may see his work. He then applies the block to the surface of the sieve, so that it may take up a sufficient quantity of the mordant, and then applies the block to the calico, giving it a blow with a mallet. He repeats this till the whole piece is done; and when it is intended to have different colours, which require different mordants to fix them, he applies as many mordants as are necessary at the same time. The calico is then dried in a stove-heated room, of a temperature varying according to circumstances, but generally about 90°, and is kept there for different periods, also according to circumstances, from half an hour to twenty-four hours. Or it is passed over a series of iron chests, kept always full of steam, and is found to be thoroughly dried by the time they have reached the end of the series. Our plate represents a better apparatus contrived for this purpose. AAAAAA are six hollow copper rollers, full of steam. The damp calico is wound round these in succession from the heap, C, by means of machinery, and by the time it has reached the last cylinder, it falls on the heap D, perfectly dry. There are vanes, BBB, fixed under every two of the rollers, and being set in motion by the steam-engine, they agitate the air and promote the drying.

(To be continued.)

INVISIBLE-VISIBLE INKS.

(From a Correspondent.)

Dissolve bismuth in nitric acid. When the writing with this fluid is exposed to the vapour of liver of sulphur, it will become black.

ANOTHER.

Dissolve green vitriol and a little nitrous acid in common water; write your characters with a new pen. Next infuse small Aleppo galls, slightly bruised, in water; in two or three days pour the liquor off. By drawing a pencil dipped in this second solution over the characters written with the first, they will appear a beautiful black.

ANOTHER.

Mix alum with lemon juice. The letters written with this ink will be invisible till dipped in water.

ANOTHER.

Dissolve fine silver in aquafortis, and after the dissolution, dilute it with two or three times the quantity of distilled water. What is written with the above ink will remain invisible for three or four months, if kept from the air, but may be easily read in an hour, if exposed to the fire, air, or sun.

A person wishing to carry on a correspondence with another, and who is fearful of having his letter opened or intercepted, can adopt the following plan:—"Write any unimportant matter with common ink, and let the lines be wide apart; then, between these lines, write the communication you wish to make with any of the above invisible inks you can most readily procure. Your correspondent is to be previously apprized of the method of

making the characters visible, and writing with common ink will serve to lull the suspicion of those who might intercept the letter, and who not finding any thing important in it, will either forward it or keep it. In either case there can be no danger, as the writing will not be visible without the proper application.

DICTIONARY OF CHEMISTRY.

ADOPTER, a vessel with two necks, placed between a retort and a receiver.

ADULARIA, a species of Felspar, called also moonstone.

AERATED alkaline water, called also carbonated alkaline water. Water containing a little soda, and made, by means of pressure, to absorb a great quantity of carbonic acid gas. The soda water of the shops.

AERIAL ACID. The name given by Bergman, and other chemists, to carbonic acid gas. It was also called mephitic acid, and calcareous acid.

AEROLITE. Meteoric stones. Meteorolites. Stones which fall from the atmosphere.

AEROMETER. An instrument used in ascertaining the mean bulk of the different gases.

AETITES. Eagle stones. A species of iron stone, so named from the eagles carrying them frequently to their nests; and formerly people ascribed to them many virtues.

AFFINITY. Chemical attraction. The power by which the *particles* of bodies unite; as attraction and gravitation signify the power by which, not the particles, but *bodies* tend to approach each other. The magnet draws iron after it by the power of attraction, but iron draws oxygen from the atmosphere, and combines with it, forming rust by the power of affinity. Or, affinity is the attraction which exists between bodies at insensible distances; while attraction, properly so called, extends to sensible distances. Affinity is called homogeneous when it takes place between particles of the same body: For example, if two pieces of lead are melted together, their particles combine and form one mass; this is by virtue of the homogeneous affinity between the particles of lead. But if portions of lead and tin be melted together, they will also form one mass; and as these bodies are different, the affinity by which they combine is called heterogeneous affinity. There is another species of affinity called elective, which means the greater affinity which exists between some bodies than others. Thus, when muriatic acid is added to carbonate of lime, it combines with the lime, displacing or setting the carbonic acid gas at liberty. This is said to be owing to the muriatic acid possessing a greater affinity for lime than carbonic acid, and this greater affinity is called by some writers elective affinity.

AGALMALOLITE. Figure stone. A mineral usually brought from China, and hewn into a variety of figures.

AGARIC MINERAL. Rock milk; also mountain milk.

AGARICUS. Mushrooms. Chemically speaking, the most like animal matter of all the known plants.

BIOGRAPHICAL NOTICE OF BERGMAN.

BERGMAN was a native of Sweden, being born at Catherineburg, in West Gothland, in 1735. He was intended for either the law or the church, and was sent to Upsal, the seat of a university, to study; but he had a great and invincible attachment to mathematics and philosophy, and absolutely fell ill when he was prevented by his friends from indulging his inclination. It was at length found necessary, to preserve his life, that the natural bent of his mind should not be thwarted, and he was allowed to devote himself to his chosen studies. Linnæus was at that time at the height of his reputation, and enjoyed in his own country that distinction he so well deserved. His success and his example begot a vast deal of enthusiasm in the minds of all the youth of Sweden for the study of natural history, and young Bergman shared largely in the general feeling. He attached

himself to Linnæus, and cultivated entomology in particular with considerable success. This science is much indebted to him. In 1761, he was appointed teacher of mathematics and natural philosophy at Upsal. In 1767, he became professor of chemistry at the same university; and then began that illustrious course which he continued for seventeen years, so that he became known to all the scientific men of Europe, and was considered, during that long period, as occupying the first place. He introduced order into the science of chemistry; and, by rejecting many superfluous details, left the minds of his pupils free to engage with more important matters. He collected and arranged cabinets of chemical substances and apparatus, and of minerals; and formed a number of pupils, who contributed to the advancement of the science. He was, perhaps, more distinguished by the correctness and extent of his general views than any chemist who preceded him; and if he has been surpassed by later writers, they have been indebted for it to his genius; they have surpassed him by his own assistance. Mr. Cavendish, Lavoisier, and Sir Humphrey Davy, will always be distinguished in the annals of chemistry, for the philosophical manner in which they have treated the science. Bergman was remarkable for the same spirit, and he is inferior only to those who came after him. He died at the early age of forty-nine, after a life spent in laborious research, and crowned with the most brilliant success. It will be found, we believe, that most of the men who have improved science and the arts on the continent of Europe, particularly within the last century, have been, like Bergman, bred up to study, and have either passed their lives in the quiet of a university, or been called from the reputation they have acquired, to take an active part in the management of affairs. On the contrary, we believe it will be found, that the great improvers of science and art in our country have been men of business,—men who did not pursue philosophy as a trade, but found it by accident, and then kept to it as an amusement, or found repose from more busy cares under its extended shelter. The consequence has been, that while more systematic and more logical views of science have been taken on the Continent, more useful discoveries have been made in England. Of such systematic writers Bergman and Lavoisier were two of the chief; and to Mr. Cavendish and Sir Humphrey Davy we must give the credit of being useful discoverers. When such different talents are united, when to diligent research, and patience and acuteness in making experiments, are added comprehensive and systematic views, we have a perfect chemical philosopher, such as we wish our youthful readers to take as a model. May they be successful discoverers, like Sir Humphrey Davy, and systematic reasoners, like Bergman.

TO CHANGE FLUIDS OF DIFFERENT COLOURS.

Among the numerous charlatans who contrive to get a living in Paris, by gratifying the love of the Parisians for *sights*, there are some who call themselves chemical philosophers, and who contrive to amuse the gaping crowd for hours together, by producing a change in the colour of fluids, while they appear merely to pour them from one bottle or glass into another. They probably effect this by breathing in the liquid, having previously tinged it blue with tincture of cabbage. The tincture is thus made:—Cut fresh leaves of red cabbage into small pieces, pour over it boiling distilled water, and suffer the whole to macerate a few hours. Decant the fluid, and mix it with one-eighth of its bulk of spirit of wine, and it is fit for use.

To produce changes of colour, add a sufficiency of tincture of cabbage to some water to render it slightly blue, and add to this a minute portion of a solution of ammonia or hartshorn, which will

render it green. Blow into it by means of a quill, or something dipping under the surface, the air respired by the lungs, and the green tincture will first be rendered blue, and if you continue to blow into it long enough it will be rendered red. These effects are thus produced:—It is a distinguishing property of alkalies to make vegetable blues green, as it is of acids to make them red. The addition of the alkali makes the tincture of cabbage in the first instance green; the air respired by the lungs is carbonic *acid* gas, which first neutralizes the alkali, and allows the vegetable blue to assume its natural appearance, and then, when breathed in sufficient quantities, turns the blue red.

TEST FOR ACETIC ACID.

To the Editor of the Chemist.

Sir,—Having hitherto never met with a test for acetic acid recorded in any chemical work which has fallen into my hands, except saturating of the suspected liquid with an alkali, and the subsequent application of concentrated sulphuric acid to the dry salt (acetate) which extricates a gas, that is only distinguishable from other gases evolved by the same process, by our nasal organs, I am induced to send you the following as a more ready and less equivocal method of detecting acetic acid:—

Add to the liquid supposed to contain the acid, any of the alkalies nearly to saturation; then drop in a solution of the protonitrate of mercury, which throws down beautiful small white shining crystals of proto-acetate of mercury, falling quickly to the bottom of the vessel, requiring 625 parts of cold water for solution, but soluble in diluted nitric acid, and converted by the pure alkalies into black oxide. If the liquid should contain any citric, malic, oxalic, or tartaric acid, they must be separated by nitrate of lead, previously to adding the protonitrate of mercury, those acids forming insoluble salts with lead. It may be remarked, that nearly one four hundredth part of real acetic acid may be discovered by these means. The peracetate of mercury being a soluble salt, an alkaline acetate will distinguish the protosalts from the persalts of mercury.

I am, Sir,

Yours, &c.

May 18. J. Williams.

ICE-HOUSES.

Some of our readers may, probably, give a satisfactory answer to the following question. We think with the author that few things are of more importance than adding to the general stock of comfort.

To the Editor of the Chemist.

Sir,—I should be very much obliged to any one of your Correspondents, who would instruct me in the simplest and cheapest method of forming an ice-house or cellar, as connected with a plan which I propose hereafter to communicate to the public, for adding very materially, I trust, to the enjoyments of the poorer members of society, more particularly of those who live in isolated situations in the country.

A work, entitled "Memoirs of the Court of St. Petersburg," speaking of the Neva, says, "Cubes of ice, of four or five feet, resembling masses of pure crystal, are squared with hatchets upon the banks of that river, preparatorily to their conveyance to the ice-cellars with which *every house* is provided." And Mr. Cobbett, in his Cottage Economy, observes, in opposition to the vulgar notion upon the subject, "An ice-house should not be under ground, nor shaded by trees, but exposed to the sun and air;" that "its bed should be three feet above the level of the ground, and composed of something that will admit of the drippings flowing instantly off;" and adds, that, "with some poles and straw, a Virginian will construct an ice-house for ten dollars, worth a dozen of those which cost the man of taste in England as many scores of pounds." I apprehend, however, that the ice-house here spoken of is not sufficiently durable to answer the

purpose I have in view; that both the ice and the house will require, in fact, more frequent renewals than I wish to be bestowed upon them.

I am sensible that chemistry may be made subservient to loftier objects than gastronomy; but seeing how much the lawful pleasures, the health, and the lives consequently of mankind depend upon the latter science, can it contribute to a more agreeable or useful one?

More merit, it is said, is due to the man who introduces a new fruit to society than to the vanquisher of armies; why not then to the introducer of new flesh, new fish, or new fowl to the market?

I remain, Sir,
With great respect,
Your obliged humble servant,
W. W.

BÖTTCHER, THE ALCHYMIST.

A YOUNG man (says no less an authority than Leibnitz) revived, in 1700, the almost expiring hopes of the alchymists. He arrived at Berlin, from Magdeburg, where he was born, as an uneducated boy, and there learned the art of the apothecary. Without my being able to explain how it came to pass, I know he took to gold making, and at length gave extraordinary proofs of his skill. Several eye-witnesses aver, that, in their presence, as he was about to leave his master, he threw thirteen pieces of copper money, which one of those present gave him, into a melting-dish; and after they were melted, he added to them a piece of some substance that resembled dark coloured glass, and almost immediately afterwards poured out of the melting-pot a piece of fine gold, equal in weight to the money employed. This took place before he received instruction from the celebrated Tschernhausen, in Dresden; and, it is said, he acquired his knowledge from a manuscript, with which he was entrusted by a materialist from Switzerland, and which he retained in consequence of the death of the traveller. The report, that the young man had been taught something by a Greek, who was both an adept and generous, (concludes Leibnitz) I hold to be a fable of a later period, as I enquired into the circumstances immediately the report got into circulation.

TO CORRESPONDENTS.

Iodine must excuse us for not inserting his communication. His conjecture is nearly as erroneous, and certainly not so well expressed, as the conjecture of A. B. Besides, his letter is written in a tone we can never countenance in the Chemist.

We are sorry if we have misunderstood A. B.; misrepresented him we certainly have not, as we have merely published his own letter. We repeat for his information, that the decomposition in question is nothing but the combination of the oxygen *of the vapour with the iron, while the* hydrogen *and not the oxygen is set at liberty. There is not a decomposition of aqueous vapour* and *a combination of oxygen; but the latter and the former are the same.*

ELIZABETH *will observe, by our immediate attention to her communication, how highly we value it. Ladies' favours will ever be welcome to the Chemist.*

Secret *will observe that we have made use of his communication.*

We have to acknowledge the receipt of one or two letters, expressing a wish to join the Chemical Society proposed in our last by A. W. We have no doubt that his scheme will be successful. There is a letter for him at our Publishers'.

The communication of a young Philosopher will be inserted when the Plate is prepared.

E. D . . . y is informed, that we have already given in No. V. *the best method we know of for preparing* IODINE. *Oxalic acid is a compound of carbon and oxygen. The hydrogen which has been found on analyzing it, is supposed to result from the water it contains, and not to be a constituent principle of the acid.*

*** *Communications (post paid) to be addressed to the Editor, at the Publishers'.*

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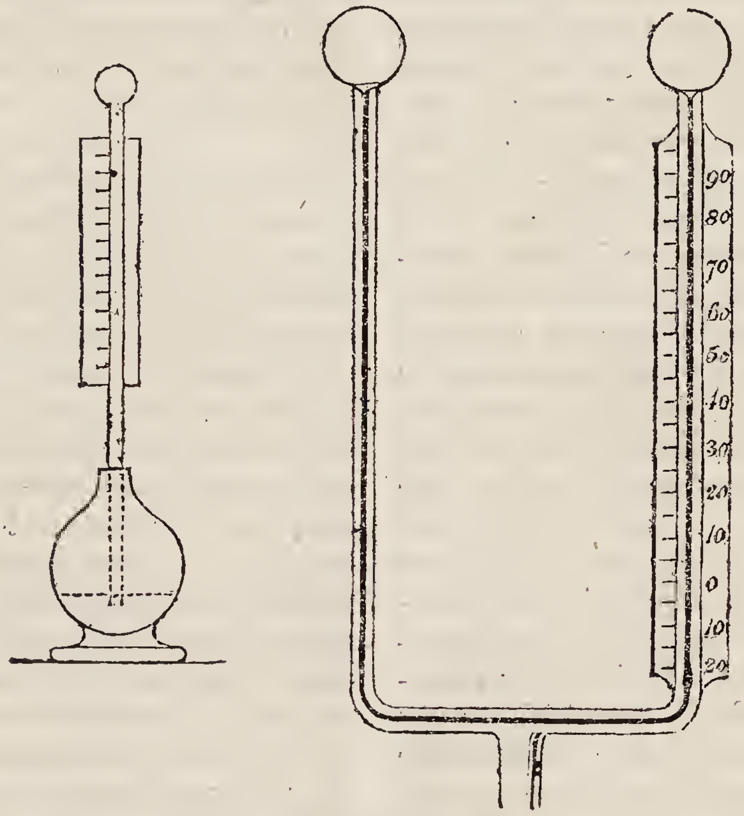
The Chemist.

"—— Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. XIII.] SATURDAY, JUNE 5, 1824. [Price 3*d*.



CONTENTS.

CHEMICAL APPARATUS.

Description of the Plate.

WE have not thought it requisite in describing the apparatus necessary for the chemist, to give drawings and descriptions of the thermometers in general use, and with which, consequently, our readers must be generally acquainted. No phenomena, however, are of more importance to the chemist than those connected with heat, and a variety of instruments have been invented

for determining its relative quantity. It has been ascertained by numerous experiments, that bodies in general are expanded by the same cause which excites in us the sensation of heat; and on this principle a number of instruments have been made, to measure, as is said, the quantity of heat, but which, in fact, are a measure of nothing else but their own expansion. But as the expansion of some substances, of mercury, for example, has been observed in conjunction with a number of other circumstances; as for example, when water boils, and would scald us, and when it freezes, and would produce a sensation of intense cold, the expansion of mercury becomes a measure of the expansion of other bodies, by the application of heat. By a reference, also, to the two intense sensations of burning and freezing, this expansion serves to give us some notion of the still more intense sensations we should probably have, were the body not before that period destroyed, when the heat is so small, that mercury itself freezes, and so great that iron melts. The *degrees of heat* mentioned in speaking of all thermometers, we here caution our readers, means, strictly speaking, only the expansion of the substance which indicates these degrees, and they are of no value and give no information beyond this expansion; but as the expansion of mercury in particular has been observed in conjunction with other circumstances, it is a sort of index to them. Thus a certain quantity of mercury contained in a glass tube of known and certain dimensions, expands a certain length when water boils under the ordinary pressure of the atmosphere; it does not expand so far when placed in contact with the human body, so as to mark what is called blood heat; it expands still less when wheat ripens and does not burn; and it is still less expanded when water becomes solid. Thermometers, therefore, do not measure, as is ordinarily said, degrees of heat, but degrees of expansion; and they are particularly valuable, because we have learnt from experience, that when the mercury reaches various points in this scale of expansion, various other effects, which it is most important for us to know, always take place, and may therefore always be expected. Having made these few remarks, rather as a caution to our readers than as instructing them, for we shall hereafter treat of heat, we proceed to describe two thermometers for measuring small variations of temperature. The instrument, consisting of a single tube placed in a bottle, is an air thermometer; the other figure is a representation of Mr. Leslie's differential thermometer.

The air thermometer consists of a bottle, partly filled with any coloured liquid and partly with air. The lower end of a glass tube, having a ball blown at the top, is cemented or hermetically sealed in the bottle, so that it may nearly reach the bottom and penetrate below the surface of the coloured fluid. Any increase in the heat to which the bottle is exposed expands the air within it, and this expansion forces the coloured liquid up the tube, which has a scale affixed to it to measure the degree of the expansion. And because air expands by the application of heat above twenty times more than mercury, an air thermometer is, in that proportion, a more delicate instrument than a thermometer made of mercury. The degrees of its expansion, however, are not so well known as those of mercury, nor have they, like the expansion of this metal, been observed in conjunction with other phenomena. The air thermometer is not, therefore, an instrument of equal utility with the mercurial thermometer, and its principal use is to discover slight variations of temperature. It is an instrument, however, which is easily made, and is advantageously employed in delicate experiments.

Mr. Leslie's differential thermometer is also an air thermometer;

and, as its name signifies, is intended to measure small differences of temperature in points or spots when compared to the general temperature of a room, or of any other similar portion of space. Thus there are numerous and important experiments as to heat made by means of mirrors, in the focus of which a considerable degree of heat may exist while no alteration whatever has taken place in the temperature of the room. Now the differential thermometer is to measure the alterations of heat in the focus of the mirror; and we are indebted to it for nearly all the accurate knowledge which has been acquired of the radiation of heat, and which has been already put to some very useful purposes. This thermometer consists of a small glass tube, bent so as to form three sides of a parallelogram, as is seen in the plate, and each end of the tube terminates in a small hollow ball, both being of the same size, and both being full of air. The tube is nearly filled with sulphuric acid tinged red with carmine. To one of the legs of the tube a scale is affixed; and the upper surface of the sulphuric acid in the graduated leg rises to 0, and the ball of this leg is called the focal ball. Suppose the instrument brought into a warm room, the air in both balls will be equally expanded, and the liquor will remain stationary: but suppose the focal ball placed in the focus of a mirror exposed to heat, while the other is not, the air in the former will be more expanded, will press on the liquid, and will force it along the tube into the other ball. This serves to show the expansion of the air in the focal ball, and to measure the heat in the focus of the mirror. This thermometer is, therefore, peculiarly valuable for determining variations of temperature at a particular point, while the surrounding atmosphere undergoes no alteration.

COFFEE.

The extensive use of this berry, to form a very refreshing drink throughout Europe, makes us suppose a short notice of it will not be unacceptable to our readers. It is one of the luxuries which have been discovered in modern times. The ancients, however renowned they may have been for slinging stones and hurling javelins, certainly knew nothing of the noble science of good living, and were as much inferior to us in the delicacy and number of their viands and drinks as in the management of ships or in the weaving of cloth. Coffee was not used by either the Greeks or Romans, and appears to have been introduced into Arabia by—let him be for ever illustrious — Megaleddin, Mufti of Ada; some persons call him Styk Sadly, and it is said the Arabs never meet to drink coffee without wishing him bliss in Paradise for the benefits he conferred on them. From Ada the use of coffee was gradually extended to other parts of Arabia, and in a short time coffeehouses were generally established both in that country and in Persia. At that period, however, it was supposed that coffee excited intoxication and improper feelings; and the enlightened governments of Egypt and Turkey, as the governments of Europe have done with regard to spirits and wine, took it into their heads to forbid the use of coffee. Further, Mahomet, who seems to have been one of the most cunning impostors the world ever saw, had forbidden, with great certainty that his commands would be obeyed, his devoted Musselmen to use charcoal as a food. His successors in power equalled him in ambition but not in cleverness, and willing, like the ministers of every religion, to extend their dominion on every possible occasion, pretended that in this prohibition of the prophet the use of charcoal for the roasting of coffee was included, and they procured the drinking of coffee to be prohibited. They made it out, also, to the satisfaction of those who at that period, thinking their own conduct of no importance, took the morals of nations under their spe-

cial protection, that coffeehouses were the haunts of the vicious and *disaffected*, and they caused them to be shut up: the system of paying for a permission to be vicious, and of subjecting houses to magisterial inspection not having been then discovered, and being in fact one of the improvements of our own age and country. Though the Muftis and Cadis succeeded very well in keeping up among the people the conviction that Mahomet was the true prophet of God, and that they were his legal vicegerents, and the legitimate successors of his power, they were not so successful in persuading them that coffee was an abominable drink, which they ought to leave to Muftis and Cadis, or pay largely for the privilege of drinking it; and after a few commotions and some throat-cuttings, all of course for the benefit of public tranquillity, the people maintained their right to drink coffee, and it has ever since, in the East, at least, been drunk with impunity. It is certainly curious to observe that the governments of modern Europe rather encourage the drinking of coffee, as a means of checking the consumption of ardent spirits. In our time, coffeehouses are places of gentility and elegance, and the reprobation they met with in Turkey and Arabia is reserved in Britain for public-houses and dram-shops. If any drink more maddening than alcohol should be discovered, which seems not unlikely, dram-shops may be expected to become places of elegant resort, and "HODGES' BEST CORDIAL" will rise to that eminence of reputation which its maker seems to think it deserves. After the Arabs had indulged in the use of coffee somewhat more than a century, it seems to have found its way into Europe. Some of it was imported into Marseilles in France, in 1664; towards 1670 it became known in Paris, and in 1672 the first coffeehouse is said to have been opened in that city, by an Armenian, who afterwards went to London. Before that, however, the use of this berry had been brought into this metropolis. In 1652, Mr. Edwards, a Turkish merchant, brought a Greek servant with him to England, who understood the art of preparing coffee, and he was the first person who publicly sold it in England. Coffeehouses soon became numerous in the metropolis; and the care of our morals, for which the government of this country,—whether republican or monarchical—whether under the influence of bishops or presbyters,—has been at all times distinguished, soon induced it to endeavour to check the licentiousness of coffee drinking, by laying, in 1660, a tax of 4d. on every gallon, and by compelling, in 1663, all coffeehouse keepers to take out a licence at the quarter-sessions. We believe that this measure had the effect of promoting the use of coffee, for we know that coffeehouses were rapidly increased in number. It is somewhat difficult to explain the cause of their subsequent decrease, coffee having almost gone out of use in England till within a few years, when it has been again revived; and not only the genuine berry, but numerous imitations of it are now consumed in every part of the country. It has been computed that the quantity of coffee now annually consumed in Europe amounts to 120,000,000lbs. avoirdupois; and though this may not be a correct calculation, it will at least serve to show the vast increase which has taken place in the use of coffee since the year 1660.

Up to the beginning of the 18th century all the coffee which was drunk in Europe was brought from the East; now it comes principally from the West. The Mocha coffee, however, still preserves its superiority, and has the finest flavour, and fetches the highest price. According to some accounts, the Dutch first brought coffee-plants from Mocha, and planted them in Batavia in 1690; according to other accounts, this did not take place till 1722. The former is the more likely, because it is said that in 1714 a plant raised at that settle-

ment was sent from Amsterdam to Louis XIV., and this plant was the parent of all the coffee-trees since cultivated in the French and Dutch West India Islands. Coffee is the produce of a warm climate, and can only be cultivated advantageously within 30 degrees of the equator, or in countries where the temperature is never lower than about 56°. The coffee-plant, we are told, is in its own nature full of juices, and requires more moisture that the rest of the plants which are cultivated in Arabia; it is therefore only planted where there is plenty of water, and generally on the hills a few miles from the Red Sea, from the summit of which there runs a fine stream. These hills are planted with coffee in terraces, and the water is conducted in a serpentine manner backwards and forwards along the side of the hills, a small ditch being made round every plant. The plants are watered every day from September till April, before sunrise, for a half or three quarters of an hour, when the water is turned off them. The Arabs select for planting, the largest and best formed beans they can find, rub them with ashes, plant them, cover them with earth and manure, water them well, and in three weeks the plants spring up. For two years they are suffered to remain, are kept constantly watered, and protected from the heat of the sun; they are then transplanted to a favourable situation, and are placed in the earth nearly three feet deep, and five yards from one another. In the West India Islands they do not plant them so far apart. In Arabia every young coffee-tree has a *pisang* tree planted close to it, which protects it from the heat of the sun. On the third year the tree bears fruit, which springs out between the branches and leaves, and very much resembles a cherry. It is at first green, and afterwards red, and is then eaten by the apes and monkeys, who seem to have as much pleasure in devouring the pulpy fruit as the Turks and Europeans have in drinking the decoction of the beans. As soon as the berries acquire a dark colour, the plants are no longer watered. The berries become of a perfect brown, and of a sweet taste. In December and January is the time for harvest, and the fruit is shook down, in Arabia, on cloths spread below the trees, and in the West Indies is gathered by the negroes. The berries ripen at somewhat different periods, and are gathered at different times. After being gathered, they are laid for ten days on mats in the sun, or on the tops of the houses. During the night they are covered with mats and stones, which press out the juice. Some merchants send them to market without separating the kernels or beans from the fruit; and this has been recommended in all cases; but in general the two are immediately separated after the coffee is dried. In order that the beans may not break into halves, they are soaked for twelve hours in water, and then pressed between two small mill-stones, so that the dried flesh falls down on one side and the beans on the other. They are then winnowed, and the beans dried in the shade; if dried in the sun, they would bleach, and white coffee is held to be spoiled coffee. In Arabia a miserable kind of drink is made out of dried husks, particularly in the neighbourhood of Betelfacki, the great coffee market for all Arabia. A coffee-tree lives for more than a hundred years. Each tree will yield, in a good soil, about 2½lbs. of beans. About 10lbs. of beans are obtained from every bushel of cherries.

TO PROTECT WOOD FROM WORMS.

TAKE walnut-shells and macerate them in water, to which add a small quantity of alum, and boil the mixture for a short space; then strain it. When cold, rub it lightly over every part of the wood to be preserved, and after it is dry rub it well with a small quantity of hogs'-lard.

CHEMISTRY AS A SCIENCE.
Art. XIII.
IRON.

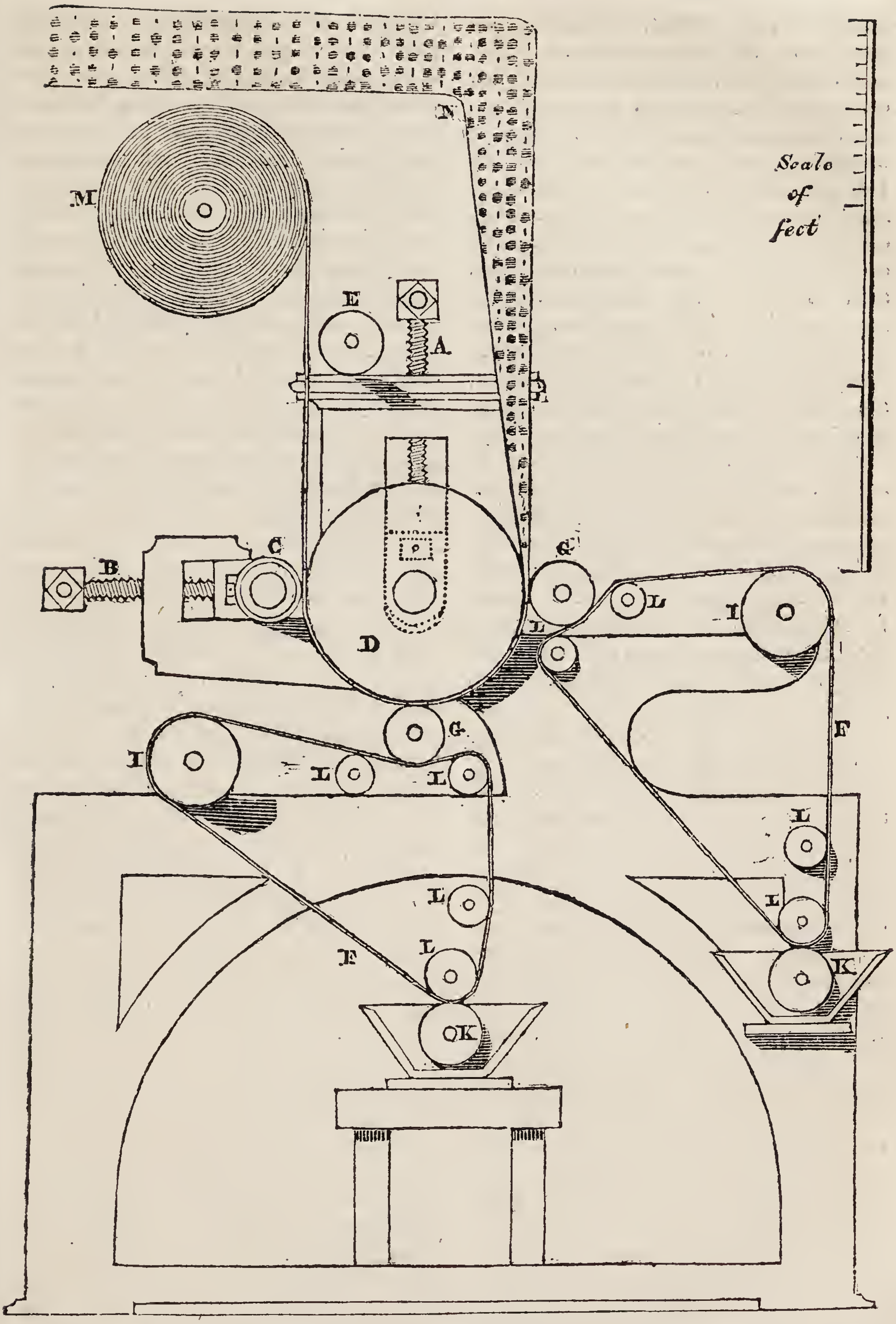
It is probable that our readers could *imagine* there was some skill and some power in chemical analysis, when we pointed out the mode in which oxygen and hydrogen had been detected, and why they were at present considered as simple and elementary substances. But their respect for that skill and power may probably decrease, when we state, that the *iron*, with which they are so familiar, is also considered by the chemist as a simple and elementary substance, in which his art can work no further change. The fact is, that the art of the chemist, or rather of the metallurgist, has already been employed to make iron, and he has not yet discovered any means of further decomposing it. Iron, wrought iron, however, is a simple undecompounded substance, and is seldom or never found in this state, but is made by art. Large masses of it have certainly been found nearly pure, in Siberia and in South America; but all the iron of commerce is obtained by a chemical process from some species of earths or stones, which are usually called iron ores. The metal, in combination with other substances, is, indeed, extensively diffused; and as it is the most useful, so it is certainly the most abundant of all the metals. Few mineral bodies, stones, or earths, are quite free from iron; the water of rivers and of springs generally contain it, and traces of it are perceptible in the juices of vegetables, and in the fluids and solids of animals. When found mixed with earths, or other matters forming stones, it is usually in the state of an oxide, or combined with oxygen, and it is principally from these substances that it is obtained for the arts. Perhaps not a single part of the globe is to be found wholly destitute of iron; and certainly there is no civilized part of the world, of any extent, where it is not manufactured from its ores. The iron of Russia and Sweden has long been celebrated for its good qualities, and that of England and France, if not quite so good, is probably more extensively worked. The chemist never makes iron as he makes oxygen and hydrogen, because iron is already made for him. We shall describe, therefore, the mode of making iron in those large laboratories, iron-works.

The first step, in order to extract iron from those ores in which it is most generally found, is to roast them. This is done by laying the ore, broken into pieces, in a kiln, mixed with small coals; or simply by laying the iron stones, mixed with coals, in alternate strata, in a heap, and then the coal is burnt till all the fuel is consumed, as is the practice in making lime. This separates the volatile parts with which the ore may be combined, and the stones are much more easily broken. The iron stone is found, after this process, to consist principally of oxide of iron and clay; and when iron ores, as is the case with the rich ores of Cumberland, are found native, in the state of pure oxide, this first part of the process is not requisite. After the one has been thus reduced to the state of an oxide mixed with clay, it is melted in large furnaces, from sixteen to thirty feet high, of various shapes. Near the bottom of these furnaces is a hole for the nozzle of a large pair of bellows, which are worked either by steam or water, and keep up a constant blast. The furnace is open at top, and has more than one hole at different parts, which can be opened at pleasure to draw off the metal, or to remove the earthy substances which are to be separated from it. Charcoal or coke, with lighted brushwood, is first thrown into the furnace, and when the whole has got heated, baskets of ore and of fuel, either coal or coke, but generally in this country coke, and on the Continent charcoal, are thrown alternately into the furnace. At the same time, a substance is added which is called *flux*, and is different according to the nature of the ore; but, in general, this flux is lime-stone. The reason for

adding this is, that, in most cases, the earth mixed with the iron is alumina or clay, which of itself cannot be melted, but which is easily fused when mixed with a certain portion of lime. By adding the lime-stone, therefore, in proportions which the eye and hand of the workman generally determine, the two earths melt, and form a sort of glass, separating from the metal, the oxygen of which, at the same time, combines with the charcoal or coke employed, and flies off as carbonic acid gas; while the metal, by reason of its greater weight, sinks, in a melted state, to the lowest part of the furnace, and is drawn off into moulds prepared for its reception. Thus, chemically speaking, there are here several decompositions and combinations. First, the ore is decomposed, and the clay unites with the lime of the lime-stone; which being in its turn, in general, a combination of lime and carbonic acid, gives up the latter, which flies off. Then, again, the coal or coke undergoing combustion, takes the oxygen from the ore, and separates from it, also in the state of carbonic acid gas, while a portion of the carbon combines with the iron. The contents of the furnace are separated into three distinct portions: one flies off as gas; another swims at the surface, and is a sort of glass, composed of all the earthy and foreign matters of the ore; and the third, the metal, sinks to the bottom. This process, after being once commenced, is carried on for years without interruption, the fires being never extinguished, and the furnaces being never allowed to cool. There is an incessant addition of the material, and an incessant production of iron. The quantities and proportions of fuel, of ore, and the nature of the flux which must be employed, are all regulated in practice, according to the nature of the ore, and the qualities of the iron to be obtained; and depend on circumstances, which are always acted on with success, though not easily described. The iron, however, which has thus run out, is not pure iron, but iron combined with a greater or less quantity of carbon, and is known under different names, according to the means used to obtain it. For our purpose, it will be enough to distinguish three great varieties; viz. white cast iron, which is extremely hard and brittle, can neither be bored, bent, nor filed, and seems composed of a series of small crystals. Grey cast iron, which is much softer, and less brittle, may be cut or bored, and is the sort of iron which is used for making artillery, and a variety of similar purposes; and black cast iron, which is the softest and most fusible of the three. The last mentioned contains the most carbon, and the first the least. To separate the carbon, and obtain pure iron, the metal is first melted in a refining furnace, in which it is exposed to a continued blast of air, which separates a part of the carbon. After being exposed to this for about three or four hours, it is run out of the furnace, along with a large portion of the vitreous oxide of iron, which has been formed by the blast, and assists in depriving the metal of its carbon. The cake of metal, after being run out, is broken in pieces, and introduced into what is called the puddling furnace, where it is exposed, at the same time, to the action of flame and of blasts of air. As soon as the metal is melted, a man called a *puddler* begins to rake it about, and a more terrific task cannot well be conceived; at the same time, he occasionally throws water on it with a small iron dish. The water is decomposed by the melted mass, the hydrogen escapes, and the oxygen unites with a portion of the iron. As the metal is agitated, it gradually loses its carbon, its fusibility diminishes, it loses all cohesion, and becomes a loose, granulated mass. As this change is going on, bubbles of gas, which are carbonic oxide, burst from it with a blue flame. After this, the heat is raised, and the loose mass becomes a number of balls of an irregular shape, which consist of iron united with the vi-

treous oxide. When it has thus become solid, it is removed from the furnace, and is beat by means of hammers driven by machinery, or it is passed through heavy rollers. It has now acquired a certain degree of malleability, but is yet very brittle when cold. It is again heated, and again hammered or rolled; and every time this process is repeated the iron is improved; the hammering or the rolling, whichever may be adopted, makes the particles approach nearer each other, and drives away several impurities. After it has undergone repeated hammerings or rollings, it is what is called in commerce bar iron, or sheet iron, and is supposed by chemists to be iron nearly in a state of purity. It is of a bluish white colour, very hard, and may be made, when converted into steel, harder than most substances. It is malleable, but cannot be hammered so thin as gold or silver, or copper; and it may be drawn into wires as fine as human hair. A wire, 0.078 of an inch in diameter, has been found capable of supporting 449.34lbs. avoirdupois, without breaking.

The various combinations of iron do not fall to be now treated of, but, for the sake of our youthful readers, we mean to say a few words of one of its combinations, though at the hazard of repeating what is already very familiar, probably, to our better informed readers. The combination to which we allude is known to them all under the name of steel, which is considered by chemists as a *subcarburet of iron.* Although the conversion of iron into steel has been practised from a very remote period, the principles on which that conversion was effected, and the chemical difference between the two substances, were not known till the close of the last century. Bergman was the first chemist who made any approach towards explaining correctly the nature of the chemical change which iron undergoes when it becomes steel. Before his time, it had been supposed that the difference was owing to plunging the metal in water, to fixing fire in it, or to combining it with sulphureous and oily particles. Bergman showed that all cast iron and steel contain carbon; and it has since been satisfactorily proved, that these different varieties of the same metal owe their different qualities to the carbon with which they are combined. According to this theory wrought iron is a simple substance; steel is iron combined with a small portion of carbon; and cast iron is iron combined with a still greater proportion. Thus, if purified or bar iron be bedded in pounded charcoal, in a covered crucible, and kept for a certain number of hours in a strong red heat, the iron gains a small quantity in weight, and acquires the properties of steel. A French chemist, M. Morveau, made steel by combining iron and diamond together; and steel may, by repeated heatings and hammerings, again have the carbon expelled and be converted into iron. The reader may, perhaps, inquire here, why it is then, if cast iron and steel are both iron combined with carbon, that manufacturers do not make steel in the first instance, without going through the whole process we have described to refine the iron before converting it into steel? The reason of this is, that cast iron in that state is generally contaminated with several other matters besides carbon, which are driven off by the same means as it is driven off. But it happens, that the very pure ore of Cumberland can be, and is converted into steel in the first instance; and in the furnaces of that part of the kingdom, by lengthening or shortening the duration of the fire, malleable iron, steel and cast iron are all obtained from the same furnace, one after another. According to this theory, we see the reason of the black spot which nitric acid leaves when dropped on steel, while when dropped on iron the spot is whitish green. In the steel the carbon is made visible. The length to which this Article has now reached obliges us to postpone its conclusion till next week.



THE MANUFACTURE OF COTTON.

(*Continued from* p. 188.)

THE plate prefixed to this Article represents a mode of printing three distinct colours on cotton at the same time. A is a screw to give the requisite degree of pressure to the main roller; B another screw to give pressure to a copper roller, C, which has one of the patterns engraved on it, and receives its colour from a small box, which cannot be shown by the print; D is the main roller round which the calico passes, in order to receive the printed impression from the three smaller rollers, C G G; E is a wooden roller intended to guide a blanket, against which the white calico lies; F F represent two blankets, which receive the colour

from the two boxes, K K, and impart it to the two wooden rollers, G G, each of which has a pattern cut on it, and stamps it on the calico, as it revolves with a regular motion round the large roller, D; I I are rollers which guide and stretch the blanket. Within each of the colour boxes there is a roller contrived for feeding the blankets, and L shows the wooden rollers for guiding and stretching the blankets, four of which belong to each; M is the roll of white calico; and N is the calico after being printed of the three patterns on the three rollers. Twenty pieces of calico, fastened together by the ends, each containing 28 yards, are in general printed by this machine at one operation, it being so contrived that they pass over the different rollers in one uninterrupted line till the whole are finished. It prints at the rate of about seven yards of calico in a minute.

We concluded our last Article with a description of the mode in which the calico is dried: and after this process is completed, the pieces are passed, by means of a winch, through water, in which a little cow-dung is mixed. The object of this part of the process is to remove any of the mordant which has not actually combined, and which would otherwise stain the white or unprinted part. Perhaps, too, as it has been found that cow-dung contains a substance like bile, a quantity of animal matter is imparted by this process to the cotton, which contributes to heighten the colours. After the dunging, which takes from five to forty minutes to perform, the pieces are taken to the river or water wheel to be effectually washed, after which they are passed through tepid water, to satisfy the workman that every impurity is removed. They are then put into a copper boiler containing pure water, into which a sufficient quantity of madder has been broken; a fire is made under the copper, and the pieces are constantly turned, either by a hand-winch or by a steam-engine, so as to pass every part of them through the liquor till it boils, and in some cases for a quarter of an hour after it boils. When the mechanical part of the work is done by a steam-engine, the ends of several pieces are fastened together, and they are kept in constant motion through the madder-vessel; and the introduction of this mode has been found to save a great deal of labour, as where it is employed one man is enabled to attend three dyeing-vessels at one time. After the goods have been passed through the madder-copper, they are carried to a boiler containing wheat-bran and water, in which they are winched for a considerable time to purify the white ground from the discolouration of the madder. Although this process impairs the intensity of the colours, no other means of purifying the white ground is known which is so effectual. If this is found not sufficient to make the white clear, the pieces are laid on the grass for a few days, where they undergo a second, though a partial bleaching. Or, which is now the more common method, the pieces are immersed in a weak solution of oxymuriate of potash or soda, which effects in a few minutes what formerly required as many days, besides making it not necessary for the calico-printers to have so much ground as they formerly employed.

There is another part of calico-printing called *resist work*, which is conducted in the following manner: Resist paste is made by taking a salt of copper, either the nitrate, muriate, or sulphate, but the sulphate is preferred, and mixing it either with flour paste, with gum, or with pipe-clay and gum; and this paste is printed on the calico in any shape or pattern which it is desired shall not be made blue by dipping the pieces in the blue or indigo vat. Hence the name of the process, *to resist* the dye. It has been found that indigo, in its oxygenized state, has no affinity for cloth; and an indigo vat is formed by such a mixture of lime and sulphate of iron as will de-oxidize the

indigo. Now the instant that portion of the piece of cloth covered with the resist paste meets the indigo, the salt of copper it contains parts with its oxygen to the indigo, which renders it insoluble, and prevents it having any effect on the cloth. When the rest of the pieces have acquired by frequent dipping the requisite intensity of colour, they are washed and passed through diluted sulphuric acid; and it is found that the parts covered with the resist paste have been preserved of a good white, while all the other parts of the cloth have become of a permanent blue. This is the general mode of dying those blue calicoes which have white spots or figures; and by a subsequent dyeing in madder, figures of red or yellow are exhibited on a blue ground. In some sorts of work wax is used for a resist, but this is found to be very expensive, and though formerly much in use, is now generally laid aside. The handkerchiefs called Bandanas, when dyed are preserved from the effects of the indigo, by printing them with a preparation of tallow and rosin, on those parts which are to remain white; a part of the blue is afterwards discharged, and the handkerchiefs dyed yellow or orange, according to the pattern. If the ground, however, of the piece is to remain white, and to have only one object in indigo-blue, then the colour is imparted in the following manner:—

Twenty ounces of quick lime in lumps, as much subcarbonate of potash or the common potash of commerce, and ten ounces of orpiment (sulphuret of arsenic) are added to ten ounces of indigo finely ground in water. These proportions are mixed together with one gallon of water, the mixture is allowed to deposit its sediment, and then it is carefully thickened with gum senegal. This is what is called *pencil blue*, from the former practice of applying this colour with a pencil; and as it was necessary to use the indigo before it recovered its oxygen from the atmosphere, only a small quantity of it was ever made at any one time. Subsequently, however, a means was discovered of applying this colour by means of blocks, and this has now nearly superseded the use of the pencil. The little machine for this purpose is represented in the plate at the end of this article. A, Fig. first and second, is a box for containing the colour; B is a sieve, which floats within this box and on the top of the colour; *c c c c* are four springs, which keep the fine canvas of the sieve close down on the dissolved indigo; D, Fig. 2, is the tub containing the pencil blue, from which the box, A, is supplied as its contents are used by the printer. D is constructed on the principle of the common bird fountain, and is completely filled with the prepared indigo at the commencement of the process, and is then closely corked and sealed to prevent the possibility of atmospheric air getting admittance to it. The tube is provided with a stop-cock in case the barrel should by accident admit air and cause the box to overflow. By means of this sieve and the blocks the workman applies the indigo, as already described, when speaking of other colours, at page 188.

Besides the resist work, there is another process appropriately named *discharge work*. In this the cloth is first dyed of some uniform colour by means of a solution of some preparation of iron as a mordant, and one of the vegetable dyeing substances; it is then washed and dried, pressed and calendered. The colour is then discharged by the application of one of the mineral acids, previously prepared according to the nature of the dye intended to be discharged and the colour to be produced. Thus a piece dyed black with a decoction of Brazil wood, having for a mordant a solution of iron, when printed in any pattern with an acid solution of tin, discharges the iron portion of the dye, and the black is instantly changed to crimson. In the same way a piece dyed olive colour by decoction of weld, and

iron as a mordant, is instantly changed, by a similar acid solution of tin, to a bright yellow. Different drabs and slate coloured stuffs, which have been coloured by means of iron, may also be changed; but the colour of the places discharged will depend on the substances with which the cotton was originally dyed. By this process, to which the dyer is wholly indebted to chemistry, and which depends altogether on the different affinities of the mordants of the colouring substances and of substances used to discharge the colours, almost any variety of shade may be produced, and for us to enumerate them all would be to refer to almost all the colours which the dyer uses. For a finer kind of discharge work, instead of the mineral acids and a solution of tin citric acid, the juice of lemons, is used, producing wherever it is applied a delicate white. To discharge the indigo from handkerchiefs, muriatic acid or nitro-muriatic acid is employed, which is mixed with gum or flour paste, and is then applied to the silk by means of a block, on which the desired pattern is cut, and a yellow colour is produced wherever it is applied.

(*To be concluded in our next.*)

Fig 1

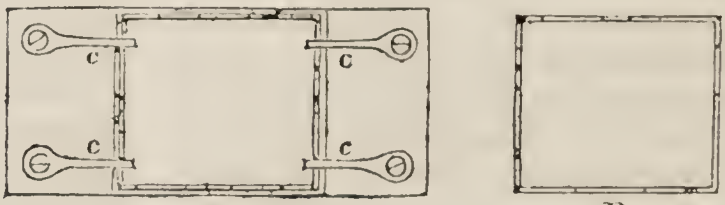
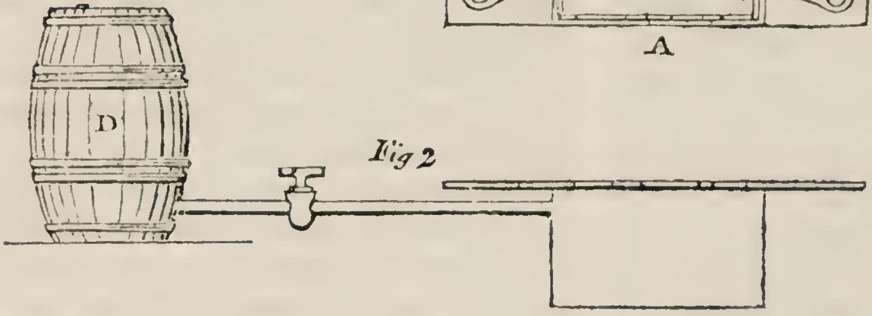


Fig 2



TO MAKE A METALLIC WIRE RED HOT BY EXPOSING IT TO VAPOUR.

Experiments which serve for amusement, are not always those which are most instructive or most useful; but the one we are now to describe teaches the nature of flame, and has been applied by Sir Humphrey Davy to create light for the miner when the flame of his candle is extinguished. Take a platina wire, one-sixtieth or one-seventieth of an inch in diameter, coil it up at one end, and heat it red hot in a candle. Pour about 20 drops of sulphuric ether into a wine-glass, which will partly fill the glass by its vapour, and when the wire has ceased to be red hot, if brought pretty near to the surface of the ether, it will instantly begin to glow again, and continue ignited for some time. By agitating the glass so as to diffuse the ether, the ignition, when it begins to slacken, will be increased. Sir H. Davy ascertained that the combustible mixture of coal gas and air had the same effect as the vapour of ether, and he applied this fact to use in the following method:—He suspended some fine coils of platina wire above the wick of the safety-lamp, within the wire gauze cylinder. Should the flame be extinguished by the foul air, the glow of the metallic wire will continue to furnish the miner with a useful though feeble light; and as it is totally extinguished whenever the air is no longer respirable, it serves at the same time as an index of the purity of the air of mines. The experiment also shows, that there is, on common occasions, an invisible species of combustion going on; and that if we wish to make the most of our fuel in producing heat, we must cause it to burn briskly.

DICTIONARY OF CHEMISTRY.

(*Continued from* p. 189.)

Air, in chemistry, means atmospheric air, or the atmosphere. Formerly this term was applied to all kinds of gases, or permanently elastic fluids. Thus we have fixed air as a name for carbonic acid gas, called also choke damp by miners; and inflammable air for the name of hydrogen gas. Now, however, the term gas, in chemistry, is substituted for the word air, and the latter is restricted to the atmosphere.

Alabaster. Opaque semitransparent stone, composed of lime united with sulphuric acid.

Album Græcum. A medicine made from the excrement of dogs; it consists chiefly of lime in combination with phosphoric acid.

Albumen. A chief constituent of animal bodies. It is so named from being found in great abundance in the white of eggs. It is distinguished from most other substances by its great liability to coagulate with heat.

Alburnum. The soft part of the bark of trees, next the wood. It has been bark, and will become wood.

Alcarrazas. The name of a coarse and porous species of pottery, used in Spain. It is made of about 36 parts of silica and 60 of a calcareous earth, mixed with alumina and a little iron. When these earths are mixed up with water, a small quantity of salt is added, and baked up with it. The vessels made of it are usually called *Demi Johns*; they are large, and employed to hold water, which, exuding through them, and constantly evaporating, keeps the portion which remains in the jar cool on the warmest day. Pottery of this description makes the best wine-coolers known.

Alchemy. The art of transmuting metals into gold and silver, and preparing the elixir vitæ, or universal medicine.

Alchymists. A sect who pretended to understand the art of making gold and silver. They are supposed to have existed from the third down to the beginning of the 19th century. Their place is now supplied by quacks, who impose on nobody but the most ignorant and credulous; the alchymists in their day imposed on the most enlightened and sagacious men.

Alcohol. *Spirits of wine; pure spirit.* It is obtained by the distillation of liquids which have undergone fermentation, and by subsequent rectification,

Ale is well known, by name at least, to our readers. It differs from beer chemically, by the sugar of the wort not having been thoroughly decomposed, and containing more mucilage.

Alembic. Another name for a *still*; a vessel used for chemical distillation.

Alembroth Salt. A salt consisting of ammonia, muriatic acid, and mercury.

Algaroth, powder of, a preparation of antimony, which is violently purgative.

Alkahest. The name which the alchymists gave to a pretended liquor, which was to dissolve all substances. Kunckel asked, "If it dissolve all substances, in what vessels can it be contained?

Alkalescent. Tending to, or possessing alkaline properties.

Alkali. A general name for an important class of bodies, possessing the following properties:—They neutralize, that is, destroy the distinguishing properties of, and are neutralized by, acids; they change vegetable blues or purples to green, reds to purple, and yellows to brown; have an acrid taste, corrode animal matter, with which they combine and are neutralized, and they are soluble in water. Formerly the term was restricted to potash, soda, and ammonia. Some chemists proposed to extend it to lime, barytes, and strontian; but this was not adopted; and now it is generally applied to a number of vegetable substances, such as *morphia*, *quinina*, &c. which have lately been discovered.

Alkali, fixed. *Potash* and *soda*.

Alkali, mineral. Formerly a name for soda.

Alkali, prussian, or *phlogisticated*. An old name for a combination of one of the fixed alkalies with prussic acid.

Alkali, volatile. *Ammonia.*

ON THE HOT MINERAL WATERS OF THE CORDILLERAS OF VENEZUELA. *By J. B. Boussingault and Mariano di Rivero.*

The springs of Onoto issue copiously from gneiss. Their temperature is 44°.5 of the centigrade thermometer. Their height above the level of the sea is 702 metres. From the bottom of each reservoir bubbles of azotic gas arise, from time to time, in great abundance. The springs of Mariano have a temperature of 44° centig.; but in particular spots it is from 56° to 64°. They contain a very little sulphuretted hydrogen. They also rise from gneiss, and evolve azote. Silica is the predominating ingredient in solution. Their height above the sea is 476 metres.—*Annales de Chimie & de Physique*, vol. xxiii. p. 272.

CHEMICAL SOCIETY.

To A. M.

Sir,—Allow me to mention a few of my ideas regarding the Society which may be formed. It should not be composed of many members, perhaps not more than twenty. The members should meet once a week, at about half-past eight in the evening; out of twenty members, twelve might be expected to attend. The subscription should be a small sum, about a shilling a month. The description of books, and apparatus, to be purchased with the money raised; and all other matters regarding the interests of the society to be determined by ballot.

Supposing a Society to be formed, and to be furnished with a moderate apparatus and library, the next thing to be considered is, how are the members to study? They cannot all meet, and each set about some experiment according to his own fancy, for then every thing would be confusion. If the Society is to be continued, the business of it must be conducted with gravity and decorum. My opinion is, that the Society should take an experimental system of chemistry, Henry's, for instance, and go regularly through it; performing all the experiments contained therein, as far as their skill and apparatus would permit; and that every member, in his turn, should give a Lecture, illustrative of the experiments performed. Each lecture, with the experimental illustrations, to be the business of one evening. Let no one laugh at the idea of a parcel of *students* becoming *professors*, or exclaim, "If the blind lead the blind," &c.; for be it remembered, that they are to have a guide. I feel persuaded, that this plan would be practicable and useful. The Lecture, *at first*, might be a mere reading of what the author of the system they went by said in illustration of his own experiments. But the eloquence of every lecturer would gradually improve, as well as his practical skill in the manipulations; so that, after a time, when things got in a proper train, amusement and instruction would certainly be obtained by every member at every meeting. A fair chance would thus be opened for every one to improve, as well as be improved. I shall at present say nothing of the advantages which would arise from possessing a choice, scientific library; the books composing which of course would be circulated among the members. J. G.

The following very liberal offer was accompanied by the writer's real address; it seems well worthy of the attention of our readers; and such as are disposed to join the proposed Society should hasten to declare themselves.

Sir,—In furtherance of A. W.'s proposition, I beg leave to offer the use of a large room and my *small* collection of books, utensils, &c. twice or three times a week for twelve months.

I am, Sir,
Yours, &c.

May 28. W. J.

SILICON.

M. Berzelius, the celebrated Swedish chemist, has announced in a letter to Sir H. Davy, read before the Royal Society, that he has succeeded, by acting on dry silicated fluate of potash by potassium, in obtaining the base of silica in an insulated state. Among other substances which the fluate yielded, was hydroguret of silicon; and when this was heated in a crucible, the hydrogen was burned off, and the silicon obtained pure. In this state Professor Berzelius examined it, and found it resembled charcoal in one point, namely, varying in its combustibility as it was obtained in different states of aggregation. In its state of greatest density, it may be made incandescent without burning. It is difficult to effect its complete combustion, but 200 parts of silicon unite with 208 of oxygen to form silica. It will not burn when heated with nitre, but is brought into combustion by carbonate of potash. It burns when ignited in chlorine, forming a colourless, transparent fluid, having the smell of cyanogen. It burns also in vapour of sulphur, producing a grey sulphuret.

QUERIES.

To the Editor of the Chemist.

Sir,—Can any of your numerous correspondents inform me of the method of dissolving India rubber, (I mean nearly to a liquid,) so that it can be shaped at pleasure, and returned to its former consistency.

Yours,

A Subscriber and Reader.

TO DISSOLVE CAOUTCHOUC, OR INDIA RUBBER.

Boil it for an hour in water, cut it into slender threads, boil it again for about an hour, then put it into rectified sulphuric ether, which has been well washed with water, and cork the vessel closely up. In a few days it will be totally dissolved; and, if ether enough have been employed, the impurities will all fall to the bottom. If the solution be spread on any thing, the ether quickly evaporates, and leaves a coating of caoutchouc, unaltered in its properties. By this means it may be made into almost any shape by means of moulds. Or it may be made into tubes and such shapes, by cutting it into a uniform slip, of proper thickness, and winding it spirally round a glass or metal rod, and then boiling it for some time, when it will be found that its edges will adhere without any alteration of its properties. Pieces of it may also be made to unite very firmly by softening them with heat, and pressing them together.

Sir,—I should be happy to learn, through the medium of your Publication, what preparation those bladders undergo that are used for holding gas, with the method of preparing them.

Yours,

May 24. P.

Sir,—I lately read in an old book the following method of making an oil paper for copying drawings, &c. and which might afterwards be written or painted on; now, Sir, I shall be obliged to you, or any of your readers, who can inform me if such a paper is in use? if it answers well? and what the expense is of preparing it?—The receipt for making it is as follows:—"Take fine vellum or writing paper, and rub it over with cotton dipped in naphtha, called also *stone oil*, and *petroleum*, taking care that the naphtha is white; wipe off the superfluous oil, and hang the paper up in a warm place, or near the fire, till the oil has completely penetrated it; after this rub it over with wheat bran, and it is fit for use, being as transparent nearly as glass. When it has been used for copying the outline of any thing, which it is afterwards required to fill in, the paper may be entirely freed from the oil by exposing it to the heat of a coal fire, and if done where there is a draught so much the better. By this process," says the writer of the receipt, "the paper may be made as clear as before, and may afterwards be drawn on with water-

colours, Indian-ink, &c." Such a paper, Sir, as this would be of considerable service to me, and I should be obliged to any of your correspondents to give me the above demanded information.

I am, Sir,
Your obedient servant,
QUESTOR.

FIRE BALLS.

MR. EDITOR,—I sometimes indulge in speculations on chemistry, but am not a practical chemist, and I may therefore commit gross errors in my dreams, in which, perhaps, some of your friends who are constantly in their laboratories, may set me right. I would ask—Is there not strong reason to suppose that the great antagonist principle,—if I may use this term for two substances that appear to have a great love for each other,—of oxygen is of a metallic nature? Is not hydrogen an antagonist principle of oxygen? Does not hydrogen exist in great plenty in the upper regions of the atmosphere? Is it not supposed that when there, it is sometimes inflamed by electricity, and forms those fire-balls or meteors which are seen in the atmosphere? And are not these fire-balls, or meteorolites, or whatever they may be called, when found in the earth, known to contain a particular metal, which is scarcely found any where else? Now, Sir, supposing all these questions answered in the affirmative, I would go on, and venture to ask, If it is not possible, as I believe has been conjectured by Sir Humphrey Davy, that hydrogen is of a metallic nature, and forms the basis, in some shape or other, of all the metals on the globe? If it is not, Sir, in short, what the alchymists so long sought after, the mother metal, by which all other metals, if we knew how to use it, might be turned into gold? Excuse these questions, Sir; they may, perhaps, exercise the ingenuity of your youthful readers, as they have sometimes amused

AN OLD MAN IN HIS ARM CHAIR.

TO REVIVE OLD WRITING.

BOIL gall-nuts in wine, then with a sponge dipped in the liquid wipe over the lines of the old writing, and all the letters will again appear distinctly visible. This should not be attempted with documents the originals of which must be preserved, as it has a tendency to destroy the material, but only with such as are to be copied when legible.

TO CORRESPONDENTS.

MONTIS, *and a former Correspondent, J. W. of Stockport, are informed, that we find, on referring to the original of M. Dubuc's experiments, that the substance he used was not* chlorate, *but* muriate *of lime, or as it is now called by chemists,* chloride *of calcium; and it may be obtained by dissolving carbonate of lime in muriatic acid.*

We beg to refer C. C. to Nos. III., IV. and V. *of our Work; and we shall be ready, after he has read the Articles in them on the subject to which he alludes, to give him, as far as lies in our power, any further and more specific information he may require.*

J. G. will observe, by our Number this week, that the first part of his Letter is in a great measure unnecessary. The suggestions as to the mode of conducting the Society are worthy of consideration; and we have, therefore, taken the liberty of inserting this part only of his communication. If he wants the remainder of his Letter he will find it at the Publishers'.

The Article alluded to by our friend, A Chemist, will be inserted when the Plate is prepared.

The Letter of LUZITANUS, *with his handsome offer to the Chemical Society, came too late for insertion this week. It will appear in our next Number.*

MORPHINE IODINE *also in our next. The request of A. M. shall be attended to; and in future we shall distinguish the proposer of the Chemical Society by A. M. and not A. W.*

*** *Communications (post paid) to be addressed to the Editor at the Publishers'.*

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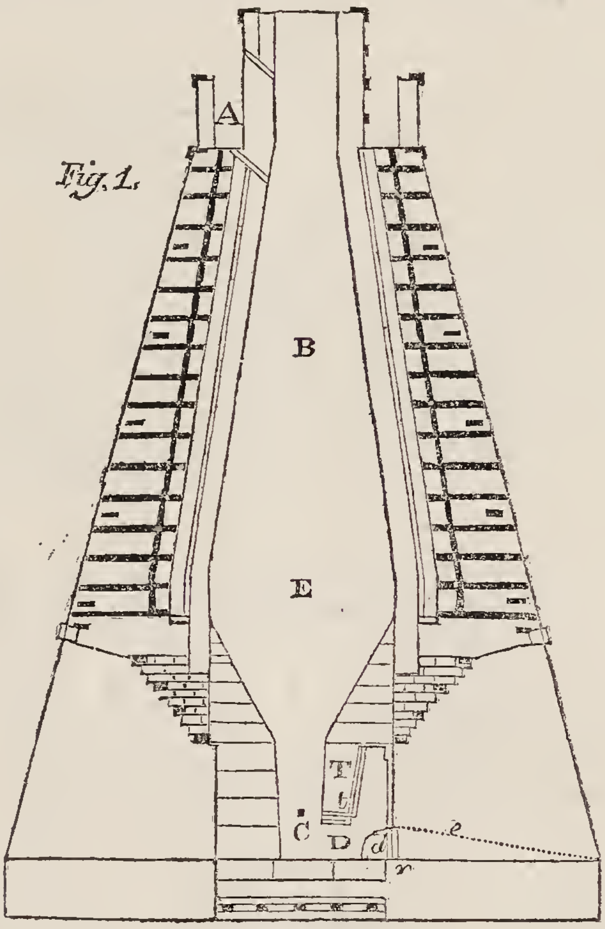
The Chemist.

"——Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. XIV.] SATURDAY, JUNE 12, 1824. [Price 3*d*.

Fig. 1.

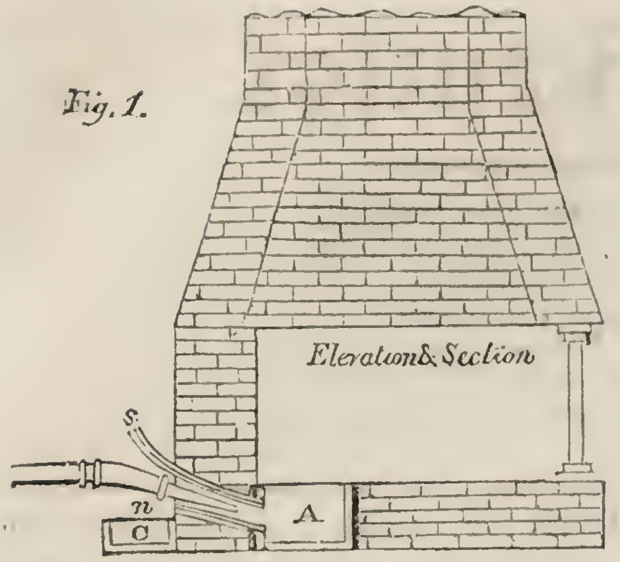


CONTENTS.

CHEMISTRY AS A SCIENCE.
Art. XIII.
IRON.

(*Concluded from* p. 201.)

We concluded the article in last week's Number by stating the chemical difference between iron and steel. The former is an undecompounded substance, the latter consists of the former united to carbon or charcoal. The process by which the former is obtained pure from its mixture with earths and other substances we also described in



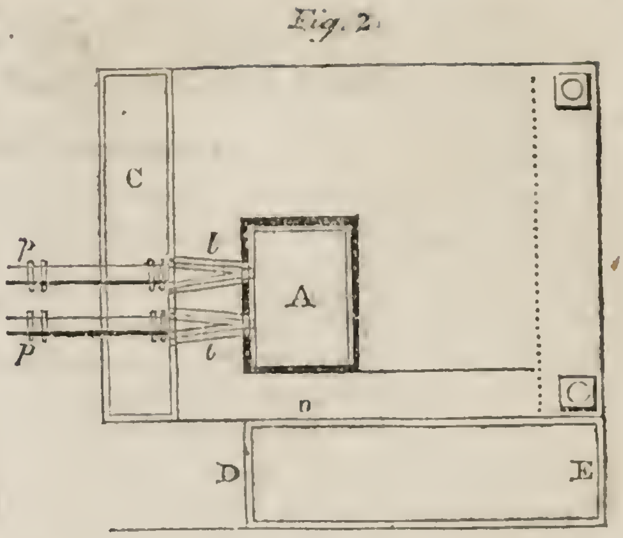
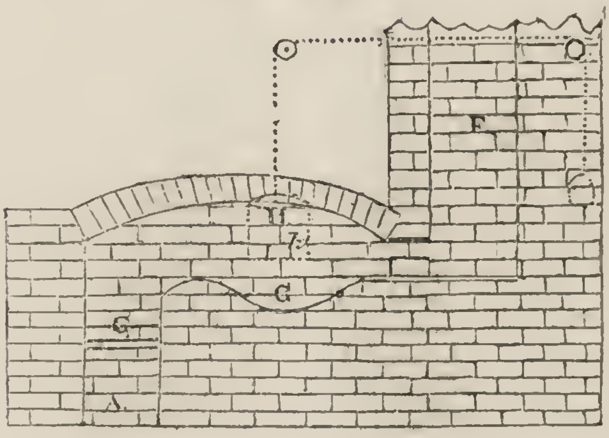


Fig. 3.



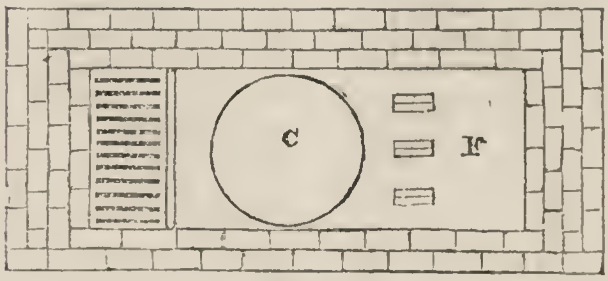


Fig 4.

the last article; and as the one or two little plates we had selected to illustrate the process were not then ready, we give them in the present Number. We shall now describe some different kinds of steel and different modes of making them.

It has been already stated that chemists consider wrought or hammered iron as the pure substance, steel as iron combined with carbon, and cast iron as only differing from steel by containing a still greater quantity of carbon. The first mode of making steel is that which we alluded to in the last Number as being carried on in Cumberland, where, by a proper regulation of the heat it is made from the ore. *Natural steel*, however, as it is called, is made from cast iron, which is exposed to a violent heat in a furnace. Part of the carbon is then supposed to combine with the oxygen, and fly off as carbonic acid gas, while the remainder, in combination with the pure iron, constitutes it steel. This steel is rather of an inferior quality, it is softer than the other sorts, and being obtained by a less expensive process, is sold at a less price. *Steel of cementation*, the mode of making which was first discovered or at least first practised to any extent in Britain, is made by placing bars of pure iron and charcoal powder alternately in large earthen troughs or crucibles, the mouths of which

are carefully closed up with clay. These troughs are about nine feet long, and are made of a sort of sand-stone which is not acted on by the fire. They are put into a furnace and kept for eight or ten days exposed to a considerable degree of heat, when the iron is found to be converted into steel. During this process, it gains in weight from four to twelve ounces per hundred weight. The former proportion makes mild, the second very hard steel. If the heat is pushed so far as to make the steel melt, in the act of melting it will combine with a greater quantity of carbon and become cast iron. The quality of the steel thus formed depends, in some measure, on the nature of the iron employed to make it. In this state it is called blistered steel, from the bars having sometimes on their surface little blisters, as if an elastic fluid had been confined in different places. It is afterwards worked into smaller bars, and is then called tilted steel, from the name of the hammer with which the operation is carried on. When afterwards broken to pieces, welded repeatedly, and then drawn into bars, it is called *German* or *shear steel*. It has a fine grain, is equal, harder, and more elastic than natural steel. The most valuable, the most compact in its texture, and susceptible of the most brilliant polish, is *cast steel*. This is used for all the finer sorts of cutting instruments, such as razors, surgeons' instruments, &c. The method of making this was discovered at Sheffield, where it still continues to be made in the greatest perfection, about 1750, by Mr. Huntsman. He is said to have added charcoal and pounded glass to blistered steel, and to have fused it in a close crucible; but as the process was long kept secret, and as it is now known that it may be made without either charcoal or glass, it is probable this was a mistake in the description. Cast steel is only blistered steel fused in a crucible; and to obtain it of the requisite degree of hardness, it is only necessary to select blister steel which is proportionably hard or soft. Cast steel cannot, like blistered steel, be welded to iron: because, when brought to a sufficient heat for that purpose, it falls to pieces under the blows of the hammer like a piece of sand-stone.

There is some difficulty to explain this. If charcoal were added to the blistered steel, to make cast steel, it might be supposed that the combination of this substance caused it, and made the steel approach the state of cast iron; but, on the contrary, none is added, and some is burnt off in the process of melting. It has, indeed, been supposed, that in cast iron the carbon is only mechanically combined with the iron, while it is chemically united with it in steel. This supposition we hold to be inadmissible, and therefore the fact is at present not explained. Whether some other substances obtained from the crucibles enter into combination with the steel or not, we will not venture to give an opinion; but some experiments made in France, by M. Boussingault; and others made in England by Messrs. Faraday and Stodart, would seem to show that other substances besides carbon are capable of imparting to iron the properties of steel. Indeed the French authors have gone so far as to suggest that carbon may, in all cases, be replaced by silica; and some recently discovered analogies between these two substances gives some feasibility to this suggestion. It may be, therefore, that the siliceous crucibles in which the operation is carried on may supply the proper quantity of the siliceous material, which is, in fact, so minute as not to be detected without very delicate instruments and a very close investigation. At all events, all the facts connected with the conversion of iron into steel are not yet thoroughly explained, and we have given our readers the above outline rather as an account of the opinions at present entertained on the subject, than as being ourselves perfectly convinced that every step

of the process is theoretically understood.

We cannot conclude this article without referring to the acknowledged superiority which the manufacture of iron in our country, take it altogether, has over the same manufacture in every other part of the world. The bar iron of Sweden, and the steel made in India, called *wootz*, and perhaps some few instruments made in France, are better than any things of the same kind manufactured in England; but, with these exceptions, the iron manufacture of Britain has no equal. It has attained its present excellence, like the cotton manufacture, without any special encouragement from the government, and without being subjected to its watchful care. No exciseman determines, by his gauge, the quantity of materials and of labour to be put into a knife or piece of calico, nor are there any specific regulations prescribing how a furnace shall be heated or a spinning-mule erected. But many of the manufactures in our country, and almost all the manufactures of the Continent are carried on according to some rules laid down by government. The consequence has been, in all cases, that the manufacture least regulated and least *encouraged* by the government, when the circumstances of a country have been adapted to it, has been the most flourishing. It is found not only that the patronage of the public, which is never long bestowed but on objects of general utility, is the best of all encouragements, but also that this patronage is sufficient to produce the greatest possible improvement in the arts, and to check the production of spurious and base commodities. When a government sets about patronizing and regulating a manufacture, it does so according to some theoretical principle, and, in arbitrary governments, merely to gratify the caprice of the sovereign. Whatever is of use is, in nine cases out of ten, already patronized by the public purchasing it; and consequently, in nine cases out of ten, the patronage of the government is bestowed on something which is not useful to the public. As a rule, the public never buys other than useful commodities, and governments never patronize the production of any commodities which are not already sufficiently patronized, or which are nearly useless, or so costly as not to be worth the labour of producing them.

The iron manufacture throughout Germany and France is either directly under the control of the government, or greatly the object of its patronage. They appoint committees of scientific men to investigate its progress, to point out new methods, and to reward the skilful. The consequence of all this has been, that the manufacture in both countries is very sadly behind hand. They cast medallions, and statues, and ornaments equal to us, but they do not make even these superior. The encouragement of the public, directed in the first instance to procuring good scissors, knives, and other trifling instruments, is found to be capable of effecting far greater improvements in the arts than the patronage of governments; and we are quite confident, that there is not on the whole continent of Europe so stupendous a monument of skill in the manufacture of iron as the bridge over the Thames. We have been induced to make these few remarks, because we observe there is scarcely a single publication which does not call for the regulation and encouragement by government of some certain manufactures. Are the colours of the dyer fugitive, ignorant persons demand that the artisan shall, by some penal enactment, be compelled to make them fixed. Are knives made of iron and called steel, a law is instantly required to punish the seller. Does a man, eager for trade, entice the unwary to his shop and give them bad goods at a high price, this is an evil which can only be remedied, it is immediately said, by a legislative enactment. Now, on the

contrary, it is plain that laws cannot reach these evils, and those who demand them only seek to be exonerated from their own want of wariness and discretion. The proper remedy for all such evils is discretion on the part of the buyers, or a discriminating patronage by the public, by which manufacturers of bad articles, and false traders, being ruined, will always be sufficiently punished. Now for the description of our plates.

Fig. 1, p. 209, is a section of a blast furnace for melting the ore, showing its interior. The dark stripes on the walls are flues for the escape of moisture, which would not get off from such a massive building without injuring the walls when the heat is applied. A is the opening for the introduction of the materials; B is the body of the furnace; C the place where the bellows enter; D the place to which the iron as it melts sinks, while the cinder floats on it and defends it from the action of the blast. The greatest heat in the furnace is a little above C; T is the *tymp* stones which form a bridge over the cavity in which the cinder rises in a liquid state; *t* is a plate to give it greater strength, and *v* is the outlet for the metal; *d* is the *dam* stone, and *e* is a dam plate to give strength to *d*. Figs. 1 and 2, page 210, represent a section of the refining furnace. The trough, A, is made of cast metal, the bottom consisting of fire-stone or brick; it has on three sides a hollow place, through which water flows constantly from the cistern, C; *pp* are two pipes from a blowing-machine, which are kept cool by water from the pipe, *s*, which passes off by the pipes, *n*, *t t*. The pipes, *pp*, are to blow the fire in A. After the metal has been melted with coke, and the blast kept up for three or four hours, the metal is drawn out at an opening at *o*, temporarily stopped with sand. The melted mass is received into the shallow recess, D E. After the metal has undergone this refining process it is introduced into the puddling furnace, Figs. 3 and 4. A is the ash pit; C the grate; D the door for the fuel; G the cavity where the metal is laid. The flame passes over it and up the chimney, F. H is the door for putting in the metal; in the bottom of this door is a square hole for putting in the rake and other tools used by the puddler in working the metal, who can at the same time see the process through this aperture.

MR. PERKINS' ACCOUNT OF HIS STEAM-GUN.

"Observing, while experimenting with the generator, that substances, whether metallic or otherwise, when they rose from the bottom of the generator through the tube of the stop-cock, were projected with great velocity; the thought naturally struck me, that with a properly constructed gun, projectiles might be thrown with great power and economy. It also appeared to me, that it would at once settle the important question respecting velocity, as well as power of high elastic steam. No time was therefore lost in constructing a gun, and on the first experiment my most sanguine hopes were realized, as musket-balls, at the rate of 240 per minute, were projected with a velocity equal to gunpowder. I dare not speculate on the consequences of this discovery, as I feel satisfied, that the power, economy, and simplicity of this agent is such, that one projectile may be found sufficient to force any breach, or sink the largest ship, though it gives me great pleasure to hear the opinion so often repeated, that this power will be to gunpowder what that has been to the arrow.

"I have found that forty atmospheres' pressure is equal to gunpowder; viz. an ounce ball discharged against an iron target from a six foot barrel about one-thirty-second part smaller than the ball, was flattened to $2\frac{1}{2}$ inches in diameter; and at 45 atmospheres, its blow against the target liquified the lead. An ounce ball discharged from a musket with powder, with the common field charge,

at the same distance, did not show more effect. It is said, with great plausibility, that there must be some fallacy in this experiment; for as it takes from 500 to 1000 atmospheres' pressure to propel a ball with proper effect with powder, it is asked, how can it take but 40 or 50 atmospheres of steam to do the same? Having the fact before me, I think I can find the reason, which I have no doubt is the same as that, why fulminating powder, although infinitely stronger than gunpowder, will not (though it bursts the gun) throw the ball one-twentieth part so far, the power being too instantaneous for projectiles; gunpowder being less so, gives greater effect, although the mechanical pressure is much less. Steam power, acting with constant pressure on the ball until it leaves the gun, in consequence of the non-diminishing generation of it, is, I believe, the cause of the increased effect."

QUERIES.

To the Editor of the Chemist:

Sir,—I shall be obliged if, through the medium of your valuable little work, The Chemist, you could obtain me an answer to the following question:—

What are the component parts of a precipitate that is obtained by mixing solutions of morphine in prussic, and quinine in sulphuric acid, together?

As it is a subject of some importance to me, I shall be particularly obliged by your inserting the above.

Yours, very respectfully,

Morphine Iodine.

How to prepare a durable ink, which will write faintly, but become very black on drying?

H. S.

Mr. Chemist, — Admiring the obliging and liberal manner in which you have answered the inquiries of some of my acquaintance, I take the liberty of troubling you (hoping you will excuse the curiosity of a young beginner,) to inform me (in your next, if convenient) how an apparatus for the rapid decomposition of water is to be formed, as I understand there is a cheap and simple one, composed of a single series of different metals, sold at philosophical instrument makers, under the name of "A galvanic apparatus for the rapid decomposition of water."—And also, if I have not already tried your patience with my tediousness, how to cut round holes in the sides of glass cylinders. Wishing you the success that a work so useful as "The Chemist" merits.

I remain,

Your sincere admirer,

Philo Chemicus.

Sir,—A barometer tube, after being washed out with cold water, was laid in an horizontal position, and on returning, after a few minutes absence, it was found cracked in different places. The cracks went in a straight direction for about an inch, and then turned round the tube, leaving a thin strata or coat of glass, uncracked, exposed to the air, which was easily broken. Since the circumstance occurred, it has been mentioned to several persons, and it appears that similar accidents have happened to them. They are of opinion that the thicker the tube the more likely the accident is to occur; that hot steam will occasion the same thing; but cannot account for it except by mere conjecture. You would much oblige me, sir, by inserting this in your useful and scientific publication. Perhaps some of your correspondents may be able to explain the cause of this disaster. Is it the unequal expansion of the tube, or some fault in the annealing of the glass?

I am your's, &c.

Experimentum.

GRAFTING VINES.

It has long been an opinion among gardeners and botanists, that the proper time for grafting vines was January and February, for vines growing under the glasses; and

March, for those growing in the open air. But (says Mr. Braddick) out of 40 or 50 vines which I operated on in the above months, few grew, and those which did grow were weakly, and were as long before they bore fruit as if they had been seedlings planted in the place of old vines. He observed that all the plants bled profusely, and he tried to stop this by various means, but all without effect. One experiment, he says, I will mention, as it will serve to show the great power of the rising sap in the vine while its buds are breaking. On the 20th of March, in the middle of a warm day, I selected a strong seedling vine, five years old, which grew in a well-prepared soil, on a south-west wall. I took off its head horizontally with a clean cut, and immediately observed the sap rising rapidly through all the pores of the wood, from the centre to the bark. I wiped away the exuded moisture, and covered the wound with a piece of bladder, which I securely fastened with cement, and a strong binding of waxed twine. The bladder, although at first drawn very close to the top of the shoot, soon began to stretch, and to rise like a ball over the wound. Thus distended, and filled with the sap of the vine, it felt as hard as a cricket ball, and seemed to all appearance as if it would burst. I caused cold water from a well to be thrown on the roots of the plant, but neither this, nor any other plan that I could devise, prevented the sap from flowing, which it continued to do with so much force as to burst the bladder in about forty-eight hours after the operation was performed, the weather continuing the whole time warm and genial. After some further experiments, it occurred to Mr. Braddick, "that the proper time for cutting off the heads, and grafting of vines, without incurring the danger of their suffering through bleeding, was when they had reached that period of their annual growth at which the sap ceases to flow thinly and rapidly. I accordingly cut the branches of several in that state, and grafted them with the cuttings of the preceding year. All these grew; the operation being that of whip-grafting, and no other covering was used than a binding of bass, surrounded with grafting clay. From these, and various other experiments which I have since made, I feel confident in stating, that healthy vines may be successfully grafted with young wood of the preceding year's growth, from the time that the shoots of the stocks in which the grafts are to be put have made four or five eyes, until Midsummer, with every prospect of the grafts growing, and without the least danger of the stocks suffering by bleeding. They may likewise be grafted with shoots of the same summer's growth, worked into the rind of the young wood, from the time that the young bunches of grapes become visible on the stocks, till July, out of doors, or till a month later under glass. The operation must not be performed later than the period here specified, because time is necessary for the young shoots of the grafts to become hard, and ripen before winter.—(From the Transactions of the Horticultural Society.)

PARACELSUS.

Mr. Editor,—In the early history of chemistry no name is more famous than that of Paracelsus. Dr. Thompson says of him "that he was an impostor, and boasted of secrets which he did not possess; that he stole many opinions and facts from others; that his arrogance was insupportable, and his bombast ridiculous; and his whole life a continued tissue of blunders and vice." If it were not that no memorials are so false as those which are inscribed on tombs, I should be disposed to believe Dr. Thompson's estimate of the character of Paracelsus somewhat erroneous. The following simple account of the inscription over the grave of Paracelsus is from a German author. "According to the monumental record on the church walls of Salzburg, Aurelius Theo-

phrastus Paracelsus died there in 1541, during the reign of the Emperor Charles V. He was the most excellent physician of his time for leprosy, gout, dropsy, and other incurable diseases, and the poor inherited his property."

If you think this worth insertion, Mr. Editor, it is at your service.

BOMBASTUS.

TO GILD WITHOUT GOLD.

PUT an ounce of sal ammoniac and half an ounce of mercury in a crucible; cover it and lute it well, for fear the mercury should escape. Put the crucible on a slow fire for about half an hour, and then increase the heat till the crucible is red hot. When this is the case, throw the composition into cold water, and when it is cold it will be as hard as a stone. Break and grind, and dissolve it in gum-water, and wherever you lay a coat of this it will look like gilt.

BOYS' TRICKS—THE NOVELTIES OF PHILOSOPHERS.

To the Editor of the Chemist.

SIR,—In a late Number of the Chemist there is an account of a novel and curious experiment performed by Professor Leslie. That it is entertaining and curious nobody would, I should think, be inclined to deny; but its novelty I very much question, as I remember performing the same experiment (in a different manner) when not more than three years old. The way I did, and no doubt many more have done, though not so scientific, was much more simple, as the apparatus consisted of nothing more than a piece of glass or tobacco-pipe and a pea with a pin through it; the latter was put in the orifice of the tube, and by blowing through it with the mouth, the same effect is produced as by Professor Leslie's way, for the pea continues to dance up and down and twirl round while you continue to blow.

I remain,
Yours, obediently,
JAMES LEWIS.

Union-street, Borough,
May 27.

SPURIOUS PEPPER.

AN artificial pepper has lately found its way into this country from France, and been hawked about with considerable success. It consists of the grains of the *brassica napus*, over which a paste, made of flour, mixed with a little powder of Cayenne pepper, or mustard-seed, has been carefully laid and dried. The imposition may be easily detected by splitting the grains, when the artificial nature of their texture will be at once apparent.—*Mechanic's Mag.*

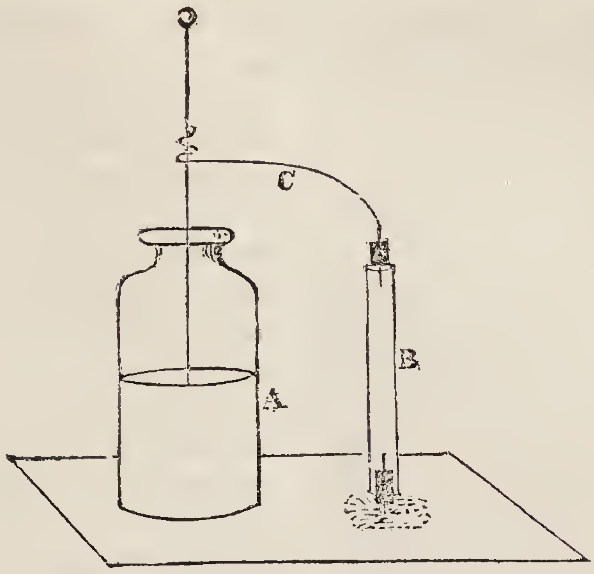
Mr. Accum informs us that a different species of spurious pepper was formerly in use. This was made of oil-cakes, common clay, and a portion of Cayenne pepper mixed together, and granulated by being first pressed through a sieve and then rolled in a cask. To detect this it was only necessary to throw it into water. Real pepper remains whole, while the artificial pepper corns fall to powder. The same test would answer for the above spurious pepper, as the flour and mustard-seed would immediately become soft, and at length dissolve.

TEST OF PERFECT VACCINATION.

WHEN a person has been vaccinated on one arm, the surgeon should vaccinate the other arm with matter taken from the first. If the first vaccination has been perfect the pustules on both arms will grow to a head at precisely the same time; and if this does not take place the system has not been properly affected, and the vaccination ought to be repeated. This simple and easy test, first brought into notice by Dr. Bryce, of Edinburgh, ought never to be neglected.

TO PRESERVE MILK.

PUT a spoonful of wild horse-radish into a pan of milk, and it will remain sweet for several days, either in the open air or in a cellar, while other milk will change.—*Hygie, ou Journal de Santé,*



INFLAMING GUNPOWDER BY ELECTRICITY.

To the Editor of the Chemist.

Sir,—In page 68, Art. X. of the Analysis of the Annals of Philosophy, is an account of some experiments by Mr. Woodward on the firing of loose gunpowder, which I beg leave to notice is far from being original, the same experiments having been performed by Mr. Lewthwaite, of Princes-street, Rotherhithe, an account of which he published in the Journals of the Royal Institution about two years back. The firing of loose gunpowder was published about 20 years ago, in a book entitled 'Imison's Elements,' from which the following is a copy :—

If the gunpowder be placed loosely upon any stand, and the interruption of the wire circuit be made in it, on making the discharge of the jar, the spark which takes place at the interruption will scatter the gunpowder without firing it. But the loose gunpowder may be fired if the shock be transmitted through less perfect conductors; in which case the discharge being less sudden, or rather proceeding in a stream, the powder will be fired. The best method of performing this experiment is that of Cavallo, which is as follows :—

F represents the gunpowder placed upon the same table upon which the jar, A, is situated; B is a glass tube, about one foot long and a quarter of an inch in diameter, full of water, and having two corks at its extremities. Into these two corks two wires are thrust, the inner extremities of which just touch the water, viz. the short wire, F, and the long wire, C, which makes the communication between the water of the tube and the knob of the jar. On making the discharge, which must pass through the small quantity of water in B, and down to the table, F, in the form of a dense stream, which generally fires the gunpowder.

Now you perceive, Mr. Editor, that neither of these gentlemen have yet made any discovery in firing gunpowder, which plainly appears to have been done near 20 years ago.

Yours, truly,

A Young Philosopher.

We beg leave to observe to our Correspondent, that Mr. Woodward's experiment is not curious from firing gunpowder by means of the electrical spark, but as showing the effect of different conductors. With good conductors the gunpowder was blown away, which is the curious part of the experiment, for the inflaming power of electricity is known to be sufficient to melt iron; but in this instance, the rapidity or mechanical force with which the stream of electricity was transmitted by good conductors, was sufficient to prevent its chemical power from operating, and the gunpowder was not inflamed, but blown away. The extract of our Correspondent, at the same time, shows satisfactorily, that even this part of Mr. Woodward's experiment was not new. —Ed.

MR. COBBETT'S METHOD OF MAKING ENGLISH GRASSES ANSWER FOR FINE STRAW HATS.

(*From the Transactions of the Society for the Encouragement of Arts.*)

Mr. Cobbett has received the large silver medal of the Society for the Encouragement of Arts, for a method of bleaching English grasses, so that they may be substituted for Leghorn straw, in the manufacture of hats. There seems so many advantages in spreading a knowledge of this useful method, that we shall here transcribe as much of his own account of it as may serve to make our readers acquainted with the process. Mr. Cobbett, it appears, was induced to turn his attention to the subject by hearing that grass was dried in America. He accordingly got some information concerning it from his son, who was then in that country, and who also sent him over some specimens of the grass. When he saw these and some Leghorn straw, he was convinced that both were made from two or three sorts of our common grasses, and of oats, wheat, and rye. He had at first some doubts whether it could be bleached in this country, but he immediately set about trying. He then gives the following account of his proceedings:—

" First, as to the season of the year: all the straw, except that of one sort of couch-grass, and the long coppice-grass, which two were got in Sussex, were got from grass cut in Hertfordshire, on the 21st of June. A grass headland in a wheat-field had been mowed during the fore part of the day; and, in the afternoon, I went and took a handful here and a handful there out of the swarths. When I had collected as much as I could well carry, I took it to my friend's house, and proceeded to prepare it for bleaching according to the information sent me from America by my son; that is to say, I put my grass into a shallow tub, put boiling water upon it until it was covered by the water, let it remain in that state for ten minutes, then took it out and laid it very thinly on a closely-mowed lawn in a garden. But I should observe, that before I put the grass into the tub, I tied it up in small bundles or sheaves, each bundle being about six inches through at the butt-end. This was necessary in order to be able to take the grass, at the end of ten minutes, out of the water, without throwing it into a confused mixture as to tops and tails. Being tied up in little bundles, I could easily, with a prong, take it out of the hot water. The bundles were put into a large wicker-basket, carried to the lawn in the garden, and there taken out one by one, and laid in swarths as before-mentioned.

" It was laid very thinly, almost might I say that no stalk of grass covered another. The swarths were turned once a day. The bleaching was completed at the end of seven days from the time of scalding and laying out. June is a fine month. The grass was, as it happened, cut on the longest day of the year; and the weather was remarkably fine and clear. But the grass which I afterwards cut in Sussex, was cut in the first week in August; and, as to the weather, my journal speaks thus:

August, 1323.

2nd.—Thunder and rain.—Began cutting grass.

3rd.—Beautiful day.

4th.—Fine day.

5th. Cloudy day. Began scalding grass and laying it out.

6th. Cloudy greater part of the day.

7th. Same weather.

8th. Cloudy and rather misty. Finished cutting grass.

9th. Dry, but cloudy.

10th. Very close and hot. Packed up part of the grass.

11th, 12th, 13th, and 14th. Same weather.

15th. Hot and clear. Finished packing up grass.

" The grass cut in Sussex was as well bleached as that cut in Hertfordshire; so that it is evident that we never can have a summer

that will not afford sun sufficient for this business.

"The part of the straw used for platting is that part of the stalk which is above the upper joint; that part which is between the upper joint and the seed branches. This part is taken out, and the rest of the straw thrown away. But the whole plant must be cut and bleached; because, if you were to take off, when green, the part above described, that part would wither up to next to nothing. This part must die in company with the whole plant, and be separated from the other parts after the bleaching has been performed.

"The time of cutting must vary with the seasons, the situation, and sort of grass. The grass which I got in Hertfordshire, than which nothing can, I think, be more beautiful, was, when cut, generally in bloom; just in bloom. The wheat was in full bloom; so that a good time for getting grass may be considered to be that when the wheat is in bloom. When I cut the grass in Sussex the wheat was ripe, for reaping had begun; but the grass is of a very backward sort, and besides, grew in the shade, among coppice-wood, and under trees, which stood pretty thick.

"As to the sorts of grass, I have to observe, generally, that in proportion as the colour of the grass is deep, that is to say, getting further from the yellow and nearer to the blue, it is of a deep and dead yellow when it becomes straw. Those kinds of grass are best which are in point of colour nearest to that of wheat, which is a fresh pale green. Another thing is the quality of the straw as to pliancy and toughness. Experience must be our guide here."

Mr. Cobbett has found the following species of grass answer:—

"Wheat.

"Melica Cærules; or, purple melica grass.

"Agrostis Stolenifera; or, Fiorin grass; i. e. one sort of couch-grass.

"Lolium perenne; or, ray-grass.

"Avena flavescens; or, yellow oat-grass.

"Cynosurus cristatus; or, crested dog's-tail grass.

"Anthoxanthum odoratum; or, sweet-scented vernal grass.

"Agrostis canina; or, brown bent grass.

"These names are those given at the Botanical garden at Kew. But the same English names are not, in the country, given to these sorts of grass. The fiorin grass, the yellow oat-grass, and the brown bent, are all called couch-grass; except that the latter is, in Sussex, called red-robin. It is the native grass of the plains of Long Island, and they call it red-top. The ray-grass is the common field grass, which is all over the kingdom sown with clover. The farmers in a great part of the kingdom call it bent, or bennet-grass; and sometimes it is called darnal-grass. The crested dog's-tail goes, in Sussex, by the name of Hendon-bent, for what reason I know not. The sweet-scented vernal grass I have never, amongst the farmers, heard any name for."

He then goes on—

"Having thus given you an account of the time and manner of cutting the grass, of the mode of cutting and bleaching; having given you the best account I am able as to the sorts of grass to be employed in this business; and having, in my former communications, given you specimens of the plat wrought from the several sorts of straw, I might here close my letter; but, as it may be useful to speak of the expense of cutting and bleaching, I shall trouble you with a few words relating to it. If there were a field of ray-grass, or of crested dog's-tail, or any other good sort, and nothing else growing with it, the expense of cutting would be very little indeed, seeing that a scythe would do the business at a great rate. Doubtless there will be such fields; but, even if the grass have to be cut by the handful, my opinion is, that the expense of cutting and bleaching would not exceed fourpence for straw enough to make a large bonnet. I should be willing to con-

tract to supply straw at this rate for half a million of bonnets. The scalding must constitute a considerable part of the expense; because there must be fresh water for every parcel of grass that you put in the tub. When water has scalded one parcel of cold grass, it will not scald another parcel. Besides, the scalding draws out the sweet matter of the grass, and makes the water the colour of London porter. It would be very good, by the by, to give to pigs. Many people give hay-tea to pigs and calves, and this is grass tea. To scald a large quantity, therefore, would require means not usually at hand, and the scalding is an essential part of the business. Perhaps, in a large and very convenient farm-house, with a good brewing-copper, good fuel and water handy, four or five women might scald a waggon load in a day; and a waggon would, I think, carry straw enough (in the rough) to furnish the means of making a thousand bonnets. However, the scalding might take place in the field itself, by means of a portable boiler, especially if water were at hand; and, perhaps, it would be better to carry the water to the field, than to carry the grass to the farm-house; for there must be ground to lay it out upon the moment it has been scalded, and no ground can be so proper as the newly-mowed ground where the grass has stood. The space, too, must be large for any considerable quantity of grass. As to all these things, however, the best and cheapest methods will soon be discovered, when people set about the work with a view to profit."

"Here there is no power of machinery or chemistry wanted. All is performed out in the open fields, or sitting in the cottage. There wants no coal mines and no rivers to assist, no water-powers nor powers of fire. No part of the kingdom is unfit for the business. Every where there are grass, water, sun, and women and children's fingers; and these are all that are wanted. But, the great thing of all is this: that, to obtain the materials for the making of this article of dress, at once so gay, so useful, and, in some cases, so expensive, there requires not a penny of capital. Many of the labourers now make their own straw-hats to wear in summer; poor rotten things, made out of the straw of ripened grain. With what satisfaction will they learn that straw, twenty times as durable, to say nothing of the beauty, is to be got from every hedge! In short, when the people are well and clearly informed of the facts which I have, through you, Sir, had the honour to lay before the Society, it is next to impossible that the manufactory should not become general throughout the country. In every labourer's house a pot of water can be boiled. What labourer's wife cannot, in the summer months, find time to cut and bleach grass enough to give her and her children work for a part of the winter? There is no necessity for all to be platters. Some may cut and bleach only. Others may prepare the straw, as before mentioned in this letter. And, doubtless, as the farmers in Hertfordshire now sell their straw to the platters, grass collectors, and bleachers and preparers would do the same; so that there is scarcely any country labourer's family that might not derive some advantage from this discovery; and, while I am convinced that this consideration has been by no means overlooked by the Society, it has been, I assure you, the great consideration of all with me."

All travellers have observed, and we ourselves have witnessed the truth of the observation, that there is no part of Italy where the peasantry are so well provided for, none where they are so cheerful and happy, as in that large and fertile district, the Vale of Arno, where most of the straw is prepared which is known in all Europe by the name of Leghorn plat. The contrast between this district and other parts of Italy is too striking not to have been noticed.

There, and perhaps there only, in unfortunate Italy, do you see a well fed and well clothed peasantry. At every house groups of sun-burnt nymphs are met with of an evening, splitting or platting the straw, while they sing merrily or chat animatedly and cheerfully. If our country is not yet far enough advanced in civilization and in gallantry to rescue our women from those irksome and severe tasks necessary to procure a subsistence for their families; if from too large a leaven of the barbarity of our ancestors yet remaining amongst us, we will continue to drive our females from the domestic hearth and the care of their children, out to labour, let us at least hope that the cheerful, the healthy labour Mr. Cobbett has described, may be substituted for the less healthy and more disagreeable toils of potatoe digging, brick-making, cotton-spinning, and cotton tambouring. It has been demonstrated, and is, on all the principles of political economy, quite certain, that in all those occupations in which the women and children of a family labour, the wages of the whole do not exceed those which a single man gains in occupations in which he is unassisted by his wife and his children. The reason, too, is plain. The wages of labour are never more than sufficient to bring up the requisite quantity of labourers, and they will always be sufficient for this whether earned by the man alone, or by the man, his wife, and two or three children. It is consequently found that a smith, who is not helped by women and children, gets as much wages as a whole family of weavers. Considered in this general point of view, there is no motive, therefore, why women should be forced to neglect their children, and why those children should be brutalized by too early and too long-continued toil, in order to procure subsistence for the family. Well understood respect, or, as it is sometimes called, chivalrous gallantry towards the other sex, is thus found to be strictly in accordance with political and civil wisdom. It may, therefore, be wished that women should not be compelled to contribute towards the subsistence of a family more than those domestic cares which double a man's money, and multiply his comforts beyond calculation. If they must contribute towards the subsistence of their families by labouring for hire, then surely it may be wished that most of them may find employment in that health-bringing occupation, for the introduction of which the country is indebted to Mr. Cobbett.

CHEMICAL SOCIETY.

The following letter was accompanied by the real address of Luzitanus.—Ed.

To the Editor of the Chemist.

Sir,—I have seen with sincere pleasure the suggestion of your correspondent, A. W.* (published in No. XI, of your valuable Journal) regarding the establishment of a Society for the instruction of young Chemists. I enter so much into the views of your correspondent, that I think it would be desirable immediately to call a meeting of the friends of the Society, for the purpose of preparing its regulations, and doing whatever may be necessary to lay its foundation on a solid basis. The first establishment will necessarily require a fund to defray the expenses, and for this purpose I am ready to contribute the sum of five guineas.

I shall also be happy to lend to the Society all the works on chemistry that my library contains, until the funds will admit the purchase of them for the Society: amongst them I have Parkes, Accum, Mackenzie, Chaptal, Cadet, Herpin, &c. I am, Mr. Editor,

Your obedient servant,

31*st May*, 1824, Luzitanus.

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* A note from this gentleman informs us, that we have made a mistake in his signature, and that it should be A. M., not A. W.

ANALYSIS OF SCIENTIFIC JOURNALS.

(*Continued from* p. 140.)

ANNALS OF PHILOSOPHY.

THIS scientific journal is extremely uninteresting this month. Mr. Baden Powell continues his lucubrations on solar light and heat, the tendency of which we are scarcely acute enough to discover. The *heating* effect of *light* is described in the next page to that in which we are cautioned not to assume any position till it has been proved by experiment. As if *light* were not the *unknown* cause of *vision;* as if *heat* meant any thing more than the *unknown* cause of the sensation of heat; and as if it were distinctly proved, that the proximate cause of both were known, and the same, or had some close and intimate connexion with each other. We say there is no proof whatever, that these two unknown causes are the same; and we add, that their effects, one producing sensations of heat, the other producing sensations of vision, are so different, that there is every reason to believe them to be totally different. While learned men continue to talk nonsense, and we are afraid they are ever the last to abandon it, there cannot be much progress made in accurate theoretical knowledge. Professor Henslow's remarks on Dr. Berger's reply, relative to the geology of the Isle of Man, may be amusing to those who like bandying hard words, but cannot add much to the general stock of knowledge, and are therefore useless, as far as we are concerned. The remaining articles are nearly all extracts.

There is an account of the LOGAN ROCK, which some sailors recently "toppled from its base," taken from "*A Guide to the Land's End.*" Then comes M. Gay Lussac's and M. Liebig's article on Fulminate of Silver, which appeared in our Journal a fortnight ago, taken from the *Annales de Chimie et Physique.* Afterwards, there is an extract from the "Medical Jurisprudence of Dr. Paris, and Mr. Fonblanque;" and also an article from the Transactions of the American Philosophical Society. There are three more original articles: one entitled, "Speculations and Inquiries respecting the Action and Nature of certain Compounds of Sulphur;" having a close relation to the doctrine of atoms, which is to chemistry what the ancient doctrine of universals was to metaphysics, viz. its alloy of nonsense: another is, a Review of the London Pharmacopœia, by Mr. Phillips; which shows, that even the learned College of Physicians are not over wise, and may yet be improved by that collision of intellect, which only dolts (for wise men know it is the source of excellence,) by charters and privileges to secure a monopoly of the rewards of skill seek to avoid. We presume, however, some little feeling of rivalry may enter into the composition of this article, for the chemical part of the London Pharmacopœia is the work of another chemist and another lecturer. We shall extract the only article of the least value in the Annals of Philosophy, and that is, An Analysis of the Argillaceous Iron Ore, by R. Phillips, F.R.S. &c.

It is well known that the greater part of the immense quantity of iron yielded by the mines of this kingdom is obtained from what is called the argillaceous iron ore. A specimen which I analyzed was of that variety, which is called at Low Moor Iron Works, near Bradford, Yorkshire, *Black Iron Stone.*

Its colour, as its name imports, is nearly black; its specific gravity 3·055; it yields easily to the knife, and becomes magnetic when heated by the blowpipe.

a. 100 grains of this ore reduced to powder, and moderately dried on a sand-bath, lost one grain, which was evidently mere hygrometric moisture.

b. As it effervesces strongly when put into an acid, 100 grains were put into a vial containing sulphuric acid, the weight of which, and its contents, were together noted. After the effervescence was over, which took place slowly, it was found that 29·3 grains of carbonic

acid were given out. The iron was evidently in the state of protoxide, for crystals of protosulphate of iron were obtained. Indeed, no percarbonate of iron probably exists, or, at any rate, none has been described, and it cannot be formed artificially.

c. 200 grains of the ore were treated with muriatic acid; nitric acid was added to convert the protoxide of iron into peroxide. The solution was decomposed by ammonia, and the peroxide of iron precipitated, being washed, dried, and ignited, weighed 97·5 grains. On repeating the experiment, the mean result was 96·15 = 48·075 per cent. The iron in the ore exists as already mentioned in the state of protoxide; and as 40 peroxide are equivalent to 36 protoxide, 48·075 are equal to 43·26 protoxide of iron, which is the quantity contained in 100 grains of the ore.

d. The residuum insoluble in muriatic acid was of a dark colour, and after being moderately dried, it was heated to redness in a platina crucible; by this it became perfectly white, and lost 5·33 grains, which is the weight of the carbonaceous matter. The insoluble residuum, consisting of silica and alumina, gave a mean of 18·12 per cent.

e. The ammoniacal solution, after the separation of the iron, was treated with carbonate of ammonia; by this a quantity of carbonate of lime was thrown down; it weighed in one experiment 7, and in the other 6·5 grains, giving a mean of 3·74 of lime, which of course existed in the ore in the state of carbonate.

f. The ammoniacal solution, evaporated so as to expel all excess of ammonia, was treated with prussiate of potash; a precipitate of a light pinkish hue was obtained, but the quantity was too small to allow of determining the quantity of oxide of manganese which it indicated.

It will then appear that the ore, usually, but improperly, called argillaceous iron ore, is, in fact, a carbonate of iron, consisting of

a	Moisture	1·0
b	Carbonic acid	29·3
c	Protoxide of iron	43·26
d	Carbonaceous matter	5·33
d	Silica and alumina	18·12
e	Lime	3·74
		100·75

As an atom of carbonic acid is represented by 22, and one of protoxide of iron by 36, the 43·26 of protoxide which the ore contains must be combined with nearly 26·4 of the 29·3 of carbonic acid, leaving 2·9 to combine with 3·74 of lime, a quantity of carbonic acid which exceeds but little the requisite proportion, and which will not account for the excess in the analysis. Although in this ore from Yorkshire the quantity of oxide of manganese is extremely small, there are some of the ores in Wales which contain nearly 10 per cent of it.

DICTIONARY OF CHEMISTRY.

ALKANET. A plant cultivated in the southern parts of Europe; the root of which is the principal colouring matter of oils, wax, and lip-salve.

ALLOY. In common life, the mixture of a baser with a more valuable metal; in chemistry, all compounds of two or more metals are called alloys, except when mercury is one of the metals, the compounds with mercury being called amalgams. Very useful tables of the properties of various alloys are published in most treatises on chemistry.

ALLUVIAL FORMATIONS, in geology, that soil which is deposited by water, and which is generally the result of the destruction of some hills or mountains.

ALMONDS. A fruit, of which there are two sorts; one of which, bitter almonds, is poisonous to birds, animals, and, if taken in sufficient quantity, to men. A great quantity of oil is obtained from this fruit by simple pressure.

ALOE. The name of a plant, the leaves of which yield a bitter juice, well known, in its dried state, as a medicine. There are three kinds

of the medicine aloes, all of which are made in Spain.

ALUDEL. The name, among the elder chemists, of a particular species of receiver for the products of sublimation, which is now no longer in use.

ALUM. Sulphate of alumina.

ALUM-EARTH. A particular species of mineral, of a blackish brown, dull, and somewhat slaty.

ALUM-SLATE. Also a mineral, of which there are two kinds, the common and glossy.

ALUMINA. A white powder obtained from alum, and various other substances; and which was considered to be an elementary earth, till Sir Humphrey Davy's discoveries led to the supposition of its being a metallic oxide. Under the idea of its being an element, the authors of the present nomenclature of chemistry, proceeding on the proper principle, that the chemical names of all substances should, as far as possible, express their chemical nature, have given to the combination of this earth with acids, the name of salts of alumina; and each individual *salt* is again distinguished by the addition of the name of the acid with which it is formed. Thus the sulphate of alumina is a compound of sulphuric acid and alum. Throughout this Dictionary, therefore, we shall place, under the respective bases of different salts, all those, and only those, which are at the same time known by some other name. Thus,

ALUMINA, sulphate of. *Alum.*

ALUMINITE. An ore of alum, found in the neighbourbood of Halle in Saxony.

ALUMINUM. The supposed metallic base of alumina.

AMADOU. German tinder; a substance much in use on the Continent for lighting pipes, &c.

AMALGAM. The combination of mercury with another metal.

AMBER. Supposed to be an indurated vegetable production, it yielding, on analysis, the same constituents as vegetable substances. It is of various uses in the arts.

AMBERGRIS. A substance found on the coasts, principally of tropical climates, and in the intestines of the spermaceti whale. It is a light, soft substance, which swims on the water, and is much used by the perfumer.

TO PREVENT BURNING THE FINGERS.

BOYS who delight in snap-dragon, as we were wont to do, may like to know the following useful receipt when playing such games. We cannot, at the same time, recommend any body to try their fingers in any other burning matter except a plate of brandy. Pound cherry-tree gum and alum, in equal quantities, into powder, and mix the powder with strong wine vinegar, and leave it in a vessel over hot ashes to digest for 24 hours. Any thing rubbed with this composition, after it has become cold, will not burn.

TO CORRESPONDENTS.

A. M. will observe that his proposition has been very favourably received; and several more letters have reached us from Gentlemen who wish to join the Society. We think, therefore, that it will shortly be necessary for him to state what he means further to do; and we should like to hear from him on the subject. A. P., G. R., Experimentum, W. H. S., and W. A. S. have all been received. We shall hand over the latter's note to A. M., and we shall communicate the suggestions of A. P. to the same Correspondent, as they seem to us more matters for private discussion and arrangement than for public remark.

Unfortunately the second communication of A Young Philosopher came too late to enable us to comply with his request. We trust, however, that whatever objections he might have had to our doing what we have done, *will be removed by what* we *have* said.

*** *Communications (post paid) to be addressed to the Editor, at the Publishers'.*

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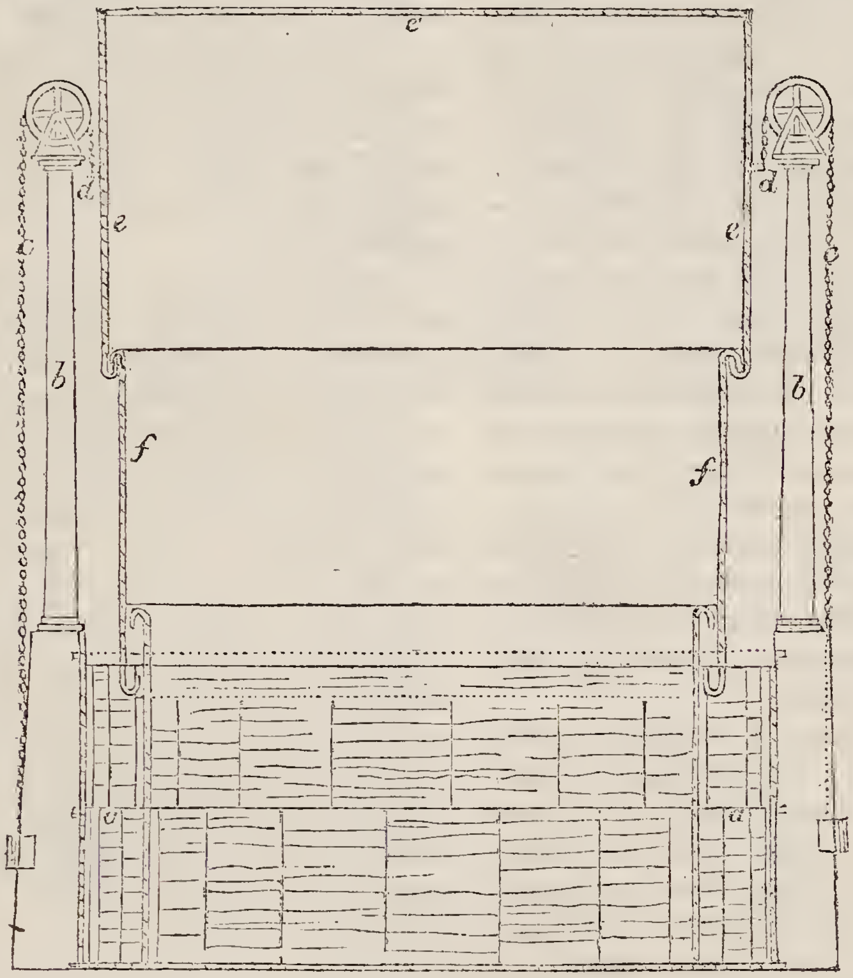
The Chemist.

'—— Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. XV.] SATURDAY, JUNE 19, 1824. [Price 3*d.*



CONTENTS.

AN IMPROVED GASOMETER.

The gasometers employed in storing up gas, until required for use, occupy, upon the old plan, much space, and are attended with considerable expense in erecting. The water tank, whether sunk in the ground or raised, must be of equal dimensions with the gasometer, both in breadth

and depth. The improved construction, which we are about to explain, affords a means of reducing the depth of the tank, dispensing with the bridge of suspension, and of increasing at pleasure the capacity of the gasometer upon a given base; thus rendering a small apparatus capable, if required, of holding a large quantity of gas, the first cost of which will be considerably less than even a small gasometer constructed upon the ordinary plan.

Mr. Tait, of Mile-end-road, the inventor, has, we believe, been for some years connected with gas establishments, and is therefore fully aware of the practical defects or advantages of the different constructions of gasometers now in use. The plate is a section of his improved contrivance:—*a a* is the tank, occupied with water; *b b* two iron columns, with pulley-wheels on the top; *c c* chains attached to a ring of iron, *d d*, extending round the gasometer, which chains pass over the pulley-wheels, and are loaded at their extremities, for the purpose of balancing the weight of the materials of which the gasometer is composed.

The gasometer is formed by several cylinders, sliding one within the other, as the tubes of a telescope; *e e e* is the first or outer cylinder, closed at the top, and having the ring of iron, *d*, passing round it, by which the whole is suspended; *f f* is the second cylinder, sliding freely within the first, and there may be a third and fourth within these if necessary.

When there is no gas in the apparatus, all the cylinders are sliden down and remain one within the other immersed in the tank of water; but when the gas rises through the water, pressing against the top of the gasometer, its levity causes the cylinder, *e*, to ascend. Round the lower edge of this cylinder a groove is formed by the turning in of the plate iron, and as it rises, the edge takes hold of the top rim of the cylinder, *f*, which is overlapped for that purpose. The groove at bottom of the first cylinder fills itself with water as it ascends, and by the rim of the second cylinder falling into it, an air-tight hydraulic joint is produced.

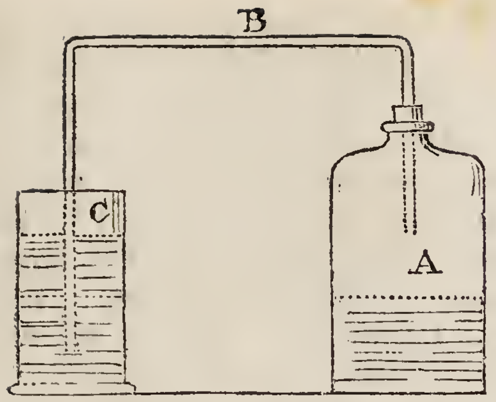
Thus several cylinders may be adapted to act in a small tank of water, by sliding one within the other, with lapped edges forming hydraulic joints, and by supporting the apparatus in the way shown; the centre of gravity will always be below the points of suspension. A gasometer may be made upon this plan of any diameter, as there will be no need of frame work, or a bridge to support it, and the increasing weight of the apparatus, as the cylinders are raised one after the other, may be counterpoised by loading the ends of the chains, *c c*.

Large cast-iron tanks upon the old plan, and the bridges for suspending the gasometers, are extremely expensive in erecting; and in London and other populous neighbourhoods, where dwelling-houses are closely contiguous to the works, great inconvenience would arise from deep reservoirs of water. Both these disadvantages are obviated by Mr. Tait's improved gasometer; and the capacity of one very large vessel, or of several vessels, may with perfect convenience be obtained by these means within very contracted premises.—*From the London Journal of Arts and Sciences.*

THE LEAD TREE.

(*From a Correspondent.*)

Procure a phial or decanter, and fil it with spring water, to which add a small quantity of sugar of lead, (about one ounce of lead to a quart of water,) then to a piece of zinc fasten a wire crooked in the form of a still; fasten the zinc in such a manner to a cork that the wire hangs downwards; immerse this into the fluid, and in a few hours the tree will begin to grow, and produce a most beautiful effect.



METHOD OF DETECTING LEAD IN WATER.

Wherever water kept in leaden vessels is allowed to come into contact with air, the lead becomes oxidated; and though the water has no direct action on the lead itself, it has on this oxide,—it dissolves a portion of it and becomes poisonous. Every body knows of the fatal disease to which those people are subject who are much employed about lead works. Lead, therefore, is a poison; and as water is very frequently kept in leaden reservoirs, it becomes of great importance to the health to have a means of detecting it. So many instances have occurred of whole families having been made unwell by using water impregnated with lead, that we earnestly recommend our readers, whenever they have the least suspicion that the water they use contains lead, to make use of the following test:—Take a bottle, A, to which adapt a cork furnished with a glass tube, B, bent at right angles. Take one part by weight of sulphuret of antimony, break it into pieces the size of a pin's head, put it into the bottle, and pour on it four parts by weight of muriatic acid; then put the cork with one end of the tube into the bottle, and the other end into another bottle or phial, C, containing the water to be examined. Sulphuretted hydrogen gas is disengaged from the materials in the bottle, A, and passing into C, will give the water, in about five minutes, if it contains the least quantity of lead, a dark brown or blackish tinge. The extrication of the gas may be facilitated by the action of heat. When applied in this manner the most minute portion of lead may be detected.

Remarkable Relation existing between the Crystalline Forms, the Atomic Weights, and Specific Gravities of various Substances.

It is not often that science is indebted to the inhabitants of Russia for improvements; whenever it is, therefore, it is our duty more particularly to acknowledge it. This makes us desirous of noticing a paper, the title of which we have literally translated, lately published in the *Annales de Chimie et de Physique*, by a Mr. Kupffer, evidently a German, but a professor at the Russian university of Casan; in which that gentleman shows, that there exists a constant relation between the volumes, the specific gravities, and the weights of the atoms of several bodies. This relation he expresses by this equation:

$$\frac{p\,s}{y} = \frac{p'\,s'}{y'} \ldots\ldots (1)$$

in which p and p' represent the weight of the *atoms* of two different substances, s s' their specific gravities, y y' the volumes of their primitive forms, the half of the diameter being supposed equal to unity. The learned professor then enters into a number of calculations, and describes how accurately he measured the angles of various crystals, to show that his formula gives very nearly the same results as the calculations of the weights of atoms, which have been made according to the atomic theory. Not exactly comprehending this marvellous relation, we merely state it, leaving our readers to draw what instruction from it they can. For ourselves, however, we must observe, and we believe others may be sensible of the same circumstance, that our veneration is always in proportion to our ignorance; that we never worship when we have knowledge; and, like Boniface in the play, who liked Latin all the better for knowing nothing of it, we have a prodigious respect for every thing relative to atoms and their relations, because it is all beyond our comprehension.

THE MANUFACTURE OF COTTON.

(*Concluded from* p. 204.)

That species of discharge work we mentioned at the close of our last article is not equally advantageous with other species of dyeing, because it has been found from experience that the colours made in this way are not so fast as those made in the other, and the cloth does not, of course, wash so well. There is another application of indigo, to produce a green, which is well worth mentioning. This consists in printing ground indigo with a solution of tin, (of what nature is not exactly known, as it was a patent invention,) and then fastening the indigo with what is called *China blue dipping*. The goods are then dyed in bark or weld, which converts the blue to a green, and the whites are cleansed by the ordinary bleaching processes. This mode of dyeing green gives a most beautiful and permanent colour. The china blue just mentioned is indigo ground fine, then thickened and printed on the cloth. It is afterwards dissolved and chemically united to the fabric, by alternate immersion in a solution of sulphate of iron and lime water.

Citric acid, or concentrated juice of lemons, is principally employed by dyers and printers to produce white figures on self-coloured grounds, produced by madder and other dyes. The acid is mixed, either with gum or flour paste, to a proper consistency for the block, and wherever it is applied it discharges the mordant and produces a most delicate white. When this acid is used for resist work, it is mixed with clay as well as gum, which gives it a greater body, and acts mechanically in resisting the dyes.

Aquafortis, or nitro muriatic acid, is the material used for putting yellow figures into blue *silk* handkerchiefs. The acid is mixed with gum, or with flour paste, to a proper consistence, and is then printed of the desired pattern on the coloured silk. Wherever the acid touches, the colour is discharged, and a yellow produced in its place. The handkerchiefs are then steamed by passing them over a vessel containing boiling water, which adds to the brilliancy of the colour. For producing the spots on *cotton* bandanas, a different method is employed. Pieces of fine calico, which have been perfectly bleached, are dyed as nearly of a scarlet colour as can be produced on cotton by the common method of dyeing Turkey red, and this colour is afterwards discharged, and the calico restored to its original whiteness. The discharged parts are usually in the form of spots, either square or round; and they are made by a very dilute solution of chloride of lime. The process for effecting this is somewhat ingenious, and we shall describe it a little more at length. To a powerful press, two horizontal plates are adapted, on both of which the pattern to be given to the handkerchiefs is marked. In the under plate holes are cut of the exact size of the pattern, and in the upper plate tubes are strongly cemented of the same size. The tubes of the one plate are made to correspond exactly with the holes of the other. A handkerchief piece doubled ten or twelve times, and of the size of the plates, so that this number of folds of cotton is laid between them, is then laid smoothly over the lower plate. The upper plate is attached to the cover of the press; it is lowered on the cotton, which is closely pressed together by means of the two plates and the mechanic power. The ends of the tubes fixed into the upper plate are thus brought to press on the surface of the cloth with great force, and as each tube has a corresponding hole below, any liquid poured into them penetrates right through perpendicularly, and is not spread over the cloth. When the press is fixed, a very dilute solution of chloride of lime, containing a small proportion of sulphuric acid is poured on the upper plate of the press, which having a rim round it, the fluid can only

escape by the tubes, which it does, drips through the cloth, and in ten or twelve minutes discharges the colour. As soon as this is done, the press is slackened, the cloth removed, and its place is supplied by another piece, so that the process is continued through the whole day, without interruption. Fifty pieces, containing one dozen handkerchiefs each, may be printed with one press, requiring the attendance of two persons, in the course of the day. The pieces, after being removed, must have the white still further cleared, which is done in the ordinary way of cleaning the whites of printed calicoes, and which also has the effect of heightening the brilliancy of the Turkey red. No doubt many of our readers have found the white spots of cotton handkerchiefs very soon become holes. This does sometimes happen, and is caused by too strong a liquid having been employed, or by its not having been perfectly removed from the goods before being dried and packed for sale.

There is a mode of producing a yellow on calicoes, not very generally practised, which deserves to be known. It is this:—A strong decoction of quercitron bark, thickened with gum tragacanth, is mixed with a portion of muriate of tin, and this, when printed in the usual way, produces a very fine colour. Should it be necessary with this colour to obtain a pale lemon ground, by means of acetate of alumina, the yellow made by this process will not be discoloured by the second mordant, while other strong yellows are apt to spread, and the figures to become irregular, staining the white ground whenever the piece comes a second time into the acetate of alumina.

Chintz work, the most expensive, the richest, and most delicate of all kinds of calico printing, is done in this manner:—After the calico has been properly bleached, and smoothed ready for the block, the first thing is to apply the mordant for the first colour. If this be black, acetate of iron, called iron-water, thickened with gum, is printed on the cloth, according to the pattern. This same substance, more diluted, forms a mordant for purple, and, still further diluted, forms a lilac in the dyeing copper. Thus all the different shades, from pale lilac, through purple into black, may be produced by the acetate of iron diluted with different proportions of water, and afterwards dyed with madder. In the same way, a colourless solution of acetate of alumina, thickened with gum or flour paste, makes a mordant for dark red; and by diluting it, every shade of red and pink may be produced. And if these two mordants be mixed, a mordant for colours approaching purple or red, as either material predominates, may be obtained. When as many mordants have been printed on the calico as there are to be colours of the above description, they are dried for two days, dunged till the superabundant mordants are removed, washed, and then boiled in a decoction of madder, which single boiling produces all the requisite colours. The cloth is then washed and bleached for a few days, till the whole of the ground to which no mordants had been applied becomes perfectly white. If the goods are to receive yellows, bright olives, or drabs, the same mordants are printed on the remaining white parts, diluted according to the colour to be produced, but instead of being boiled in a decoction of madder, they are to be immersed for about half an hour in a warm decoction of quercitron bark. By substituting the bark for the madder, instead of blacks, pompadours, and reds, we get dark olives, drabs, and yellows, which will vary in intensity according to the strength of the aluminous mordant. Again, if the acetate of alumina be applied to the colours already dyed with the madder before the goods are immersed in the bark, the reds may be converted into different shades of orange, and the lilacs into cinnamon colours. These different processes enable the calico printer

to produce an endless variety of colours, as we every day see exemplified. It would be in vain, indeed, to seek among natural objects for any one exhibiting all the tints imparted by the dyer. The fleeting and changing colours of the expiring dolphin, the glowing, brilliant, and varying tints of the bird of paradise, the chaste and softened hues of the rainbow, the modest pencilling of the coming morn and the crimson glow of eve, the cheerful green of spring, and the sober but many colours of autumn;—whatever there is, and all which there is in nature beautiful to look on, is imitated by the art of the dyer; and the clothing which man has made for himself almost equals in splendour the robes with which she has ornamented her greatest favourites. In no country is the manufacture of cotton carried altogether to such great perfection as in England; and proofs of the rapid manner in which it has been extended in our country may be found in the names of many of the articles. *Calico*, to give but one example, the general name for printed cottons, is derived from the city of Callicut, on the coast of Malabar; and though the manufacture of this article was not introduced into England from India till the latter end of the seventeenth century, we now supply the markets of Europe with it, and even send large quantities of it to India. Notwithstanding this great improvement, it is said, and we believe with truth, that some of the manufacturers of the Continent surpass those of our country, both in the brilliancy and permanency of their colours and in the forms of their patterns. For the former they are perhaps indebted to their brighter sun: the cause of their superiority in the latter it is more difficult to discover. In many of the English patterns there is a sort of grotesque confusion, or jumble of colours and figures, without any apparent design; while in the most simple patterns of the continental manufacturers some plan is generally perceptible. Though our flowers blow as gracefully as those of Italy, though our hills are most beautiful in their outline, though all the fine species of animals grow with us to singular perfection, and man is not in his form destitute of beauty, yet almost all the works of our hands, as far as figure is concerned, whether we take into consideration our buildings, our furniture, or the patterns of our cottons, are not in general so graceful as those of some other countries, which, in other points, are greatly surpassed by England. We certainly do not wish to acquire their show at the expense of our own solidity; but we do not see why the two may not be combined. Indeed, if all the arts should receive their fair share of attention, we look on that extensive education which our people are now giving themselves, as tending to bring about such a combination. Then we shall excel other countries in the forms of our patterns as much as we now surpass them in the small quantity of labour by which we can manufacture cotton cloth.

DICTIONARY OF CHEMISTRY.

(*Continued from* p. 224.)

AMETHYST. A gem of a violet colour, belonging to the quartz family.

AMIANTHUS. *Mountain flax.* A species of asbestus.

AMIDINE. A substance produced, according to M. Saussure, from the decomposition of starch.

AMMONIA. *Volatile alkali.* This name was given to it from possessing alkaline properties and existing in a state of gas. It was called *hartshorn*, from having been obtained by distillation from the horn of the hart; *spirit of urine*, because it was procured from that substance; and *spirit of sal ammoniac*, because obtained from that salt. The name by which it is now most generally known is derived from the same source: and the salt itself was so named from having been made originally in the neighbourhood of the Temple of Jupiter Ammon. For a long period it was supposed to be an unde-

compounded substance; now it is well known to be a compound substance, and is supposed to consist of one volume of azotic gas and three volumes of hydrogen gas; and, according to the general rules which have been followed in forming the present nomenclature of chemistry, it should receive still another name. On such points, however, a little scientific precision is dearly purchased by that confusion which is always at first occasioned by the introduction of new terms. In the present case, perhaps, this remark is peculiarly applicable, because some chemists suppose that ammonia consists of an unknown base, united to oxygen; and names derived from the constituent elements of substances must of course be changed whenever we are able, by pushing our analysis further, to detect other elementary bodies. Ammonia is used in certain manufactories, and in medicine, and it is a valuable re-agent, or test, to the chemist.

———, Acetate of, *spirit of mindererus.* A medicine employed as a febrifuge.

———, Carbonate of, *volatile salts.* The substance put in smelling-bottles.

———, Muriate of, *sal ammoniac.*

———, Sulphate of, *secret sal ammoniac; vitriolated ammoniac.* A salt discovered by Glauber.

Ammoniac. A vegetable gum, used as a medicine.

———, fixed, *muriate of lime, chloride of calcium.* Formerly so called because obtained from decomposing sal ammoniac by means of lime.

Ammoniacal Salts. All substances formed by the union of an acid and ammonia.

Ammonium. The name given by Berzelius to the supposed metallic base of ammonia.

Ammonites, *cornua ammonis; snake-stones.* These curious substances are petrifactions, and seem to owe their origin to shells of the nautilus kind. They are found of all sizes, and consist chiefly of lime-stone.

Amnios. The liquid contained in the uterus of pregnant animals; and which is found to be different in each species of animal.

Amniotic Acid. A peculiar acid, found in this liquid.

Amphibole, *hornblende.* A mineral extensively diffused.

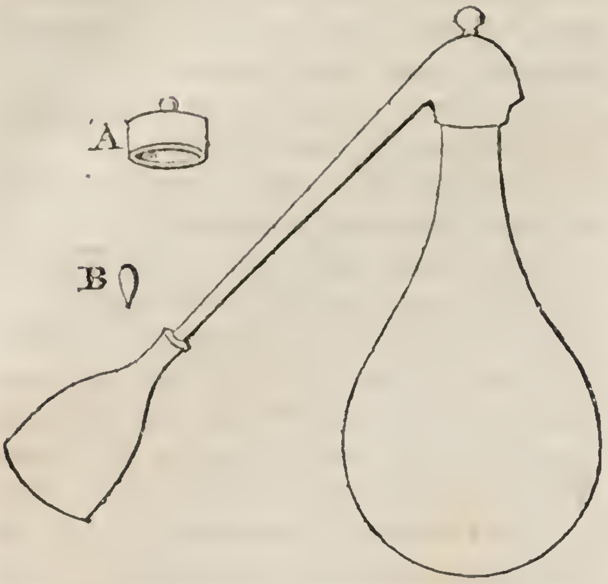
Amphibolites, *trap rocks.* Rocks chiefly composed of hornblende.

Anacardium, *cashew nut, marking nut.* The produce of the cashew-tree; it contains an inflammable and caustic liquor, very useful for marking on linen or cotton.

Analysis. The resolution of a substance into its constituent parts, for the purpose of examining them; it is not complete unless these parts are discovered and examined. It is distinguished from decomposition by this latter being a more general word, signifying every separation of compound bodies. There is frequently decomposition without analysis, but there can be no analysis without decomposition. Analysis is opposed to synthesis, which is the forming of combinations, and can seldom be effected without synthesis. When we can show the composition of any substance by analysis, and then produce that substance by synthesis, the chemical proof of its nature is complete and perfect.

USEFUL DISCOVERY REWARDED.

The quantity of iron employed in the construction of ships has been found to produce so much deviation in the compass as to render it almost a useless instrument in high northern or southern latitudes. Mr. P. Barlow, of the Royal Military Academy, Woolwich, having found a very simple method of remedying this evil, and experience having already demonstrated its efficacy, the Board of Longitude have conferred on him a reward of 500l. His method consists in placing a small plate of iron close abaft the compass, on the principle of counteracting in one direction and one place the effects of all the other iron in the ship. It is found to answer perfectly.



APPARATUS FOR PREPARING FLUORIC ACID.

Fluoric acid is generally prepared by means of a leaden apparatus, but this is very inconvenient; and Professor Silliman, of the United States, having found it so, caused an alembic of silver to be made. The above is a representation of it. The body held about a pint; it was very thick, and had a silver cover, A, so that it might serve as a crucible upon occasion. The head and its pipe held about two ounces and a half; the pipe fitted so tight into the mouth of a silver bottle, holding about three ounces and a half, that no luting was required; the bottle had a silver stopper, B, that it might serve to contain the acid when prepared, without the danger and inconvenience of transferring it to another vessel.

Two ounces of fluoric spar distilled with four ounces of sulphuric acid, without any water, yielded about one ounce of acid. The liquor soon boiled; and occasionally a puff of dense fluoric acid burst from the still, which, to avoid explosion, was left rather loose. These fumes powerfully corroded some glass articles that stood near the place, and of course their contact with the skin or lungs was most anxiously avoided; for this purpose the hands were covered with very thick gloves, and the acid was never poured from the bottle except under the chimney. The acid when dropped into water hissed like red hot iron; and a drop let fall into a dry wine-glass corroded its surface with great energy.

This acid being too strong for etching on glass, a fresh parcel was distilled, half an ounce of water being put into the receiving bottle; but this acid was still too strong, as it destroyed the varnish used to protect the glass: but on weakening it with three or four times more water it acted very well, and the plates of glass were perfectly etched in one or two minutes; and the same portion of acid served to engrave several plates in succession.

Many experiments have been tried for etching glass by the vapour of the acid, but the pure acid, when sufficiently diluted, is far superior.

TO MAKE A PAPER THAT WILL NOT TAKE FIRE.

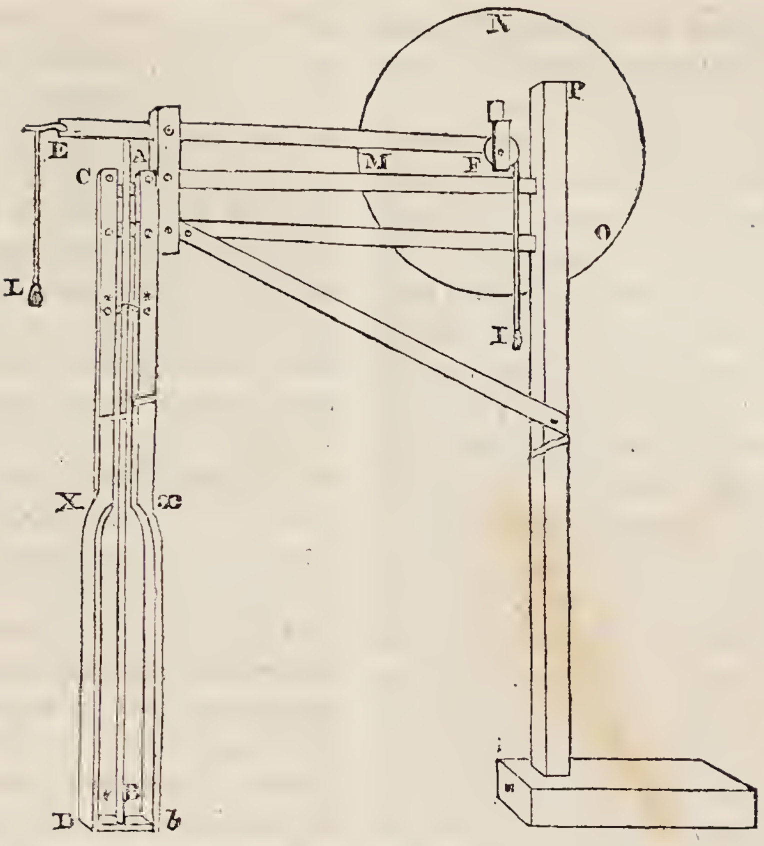
Pound a quantity of alum in a mortar, add to it a small quantity of gunpowder, and dissolve the whole in three times its weight of water over a slow fire. Dip paper twice or thrice in this solution while it is warm, and then hang it up to dry. This paper is incombustible.

FIRE UNDER WATER.

Mr. Skidmore, of New York, has observed that the flame produced by the oxyhydrogen blow-pipe may be introduced under water without being extinguished. It is only necessary not to be in a hurry, or the flame may be driven back into the blow-pipe, and occasion mischief. In the water the flame appears globular; it burns wood, and reddens metallic wires. Mr. Skidmore imagines this method of producing flame under water may be employed in naval warfare.

TO GIVE A LUSTRE TO PLATE.

Dissolve alum in a strong ley; scum it carefully, then mix it up with soap, and wash your silver with it, using a linen rag. This will give plate a fine lustre.



CHEMICAL APPARATUS.

PYROMETERS.

Description of the Plate.

In No. XIII. we described two air thermometers, or instruments for indicating, by the expansion of air, variations of temperature. The power of heat is, however, so great, that not only mercury may be made to boil and fly off in vapour, but the vessels in which it is usually contained, when employed as an instrument, may be melted and destroyed. It, consequently, can afford no measure of the expansion of other bodies by heat, when its own expansion cannot be either perceived or determined. As a substitute for it, therefore, when a higher temperature than ordinary is to be measured, recourse is had to instruments called pyrometers; and by their means chemists have created a scale to determine the different points at which metals melt. One of the first of these was contrived by Dr. Cromwell Mortimer; and though it has now been superseded by the more accurate instrument invented by Mr. Wedgewood, its principles and mode of construction are worthy of the notice of our readers. We have, therefore, given it here; and it is to be remarked, that the fusing points of several metals in books of chemistry are still given according to the indications of this pyrometer. This instrument consists of a rod of steel or brass, which, by its expansion, moves a lever turning on an axis, and points out the degrees on a plate. A B is a round rod of steel or brass, one quarter of an inch thick, and three feet one inch in length. When the rod is made of brass the point of A is still made of steel, as lasting longer, and is made to screw on and off. C D and *b* are two iron supporters, joined by a flat cross bar at bottom, D *b*, two inches long, in the middle of which is a point, one-eighth of an inch high, under B, and which enters the rod at B, serving to keep it in its place. In like manner the point, A, goes into a small hole at the under side of the lever, and the bar is further kept in its place by cross bars at the upper part of the supporters. The latter are flat or parallel to the front of the machine, from C to X, where they are twisted half round, so that the lower parts, X D, stand at right angles with the upper part. This contrivance gives freer access to the rod, for the sand or fluid into which the machine is set to measure its heat; and in making experiments care must be taken always to immerse the rod to the same height in the substance to be examined. E F a

lever turning on the axis, C; and at F and E two weights, I L, are suspended, the latter being not only heavy enough to counterbalance the longer arm, C F, but also to keep the lever steadily pressed down on the point, A. M N P O is the back of a dial plate which has been previously graduated, and has a hand or index on the other side. This instrument, in point of fact, merely shows the expansion of the brass or steel rod when immersed in certain melted or melting metals or other substances. Mr. Wedgewood's pyrometer proceeds on totally different principles. It has been found that *clay*, after being once exposed to a red heat, progressively contracts its dimensions as it is subjected to more heat. On this principle Mr. Wedgewood constructed his pyrometer. He selected a particular species of fine clay, which was diffused through water, and then the liquid was passed through lawn. After the clay had subsided it was kneaded into a paste, and then formed into small pieces in little metal moulds, which are baked in a dull red heat. For measuring the contraction which these pieces undergo, a gauge is made of two pieces of brass fixed on a brass plate, and being half an inch asunder at one end, and three-tenths of an inch at the other. The pieces of clay are of such a size as exactly to fit at the wide extremity of the scale, which is marked 0, the narrow end being marked 240°, and the scale being 24 inches long. Each of these 240 degrees has been supposed to equal one degree of Fahrenheit's thermometer, and the extremity of the scale to correspond to no less than 32.277° of that instrument. We scarcely need remind our readers that there is no connexion whatever between the two; and that the pieces of clay in point of fact indicate nothing but their own contraction and expansion. They have, however, been observed in conjunction with the expansion of mercury, the fusing of various metals, the operations of baking pottery, and other things; and thus their expansion has become an index and a mark for other facts. They are made use of by exposing the pieces of clay to the heat of the body to be experimented on; and that heat is said to be a certain number of degrees, according to the point in the scale which the pieces of clay occupy when contracted.

CHEMISTRY AS A SCIENCE.
Art. XIV.

NICKEL. COBALT. MANGANESE. CERIUM. URANIUM. ZINC.

Only one of these metals is extensively diffused, or in its metallic state put to any important use. For any interest which they possess, therefore, we might pass them by without any notice; but as substances with which the researches of chemists have made us acquainted, but which have not yet been decompounded, we must necessarily briefly describe them. The first of them presents a curious illustration of the mode of applying names. *Nickel* signifies, in German, from which it is derived, false, dirty, or foul; and in this sense is applied to the very worst description of females. Now nickel is found in different parts of Germany, and was supposed by the miners to be copper. As they could not, however, extract any copper from it, they gave it the name of *kupfer-nickel*, or false copper. When a scientific chemist of the name of Cronstedt came to examine it, about 1750, and found that it was a metal different from all others, he retained the latter part of the name, given it in reproach, and called it *nickel*, which has since been universally adopted; and thus an element of nature is stigmatized by a term, than which no more opprobrious name can be given to a woman. For any other people but Germans this is certainly of no consequence; but it is rather a curious specimen of the manner in which names, that in a scientific point of view ought to express the qualities of substances, are applied. Nickel

is rather a scarce mineral, and is always found combined with some other metals, which for a long time occasioned its separate existence to be denied. The brittle metal that is usually sold under this name always contains iron, arsenic, copper, cobalt, and bismuth. When pure it is of a fine white colour, resembling silver, and is rather softer than iron. It is malleable both when cold and hot; it is attracted by the magnet, and, like steel, may be converted into a magnet, pointing, when suspended, to the north, like a common magnetic needle. It is put to no use; and is, perhaps, most remarkable on account of its forming a part of almost all the stones which have fallen from the sky (meteoric stones) in every part of the world.

Since the year 1560, a heavy mineral, called *cobalt*, found in the mines of Germany, has been employed in most parts of Europe to tinge glass blue. From this substance, in 1733, Brandt, a celebrated Swedish chemist, obtained a new metal, to which he gave the name of cobalt. All subsequent attempts to resolve it into other metals, or make it out of other metals, have failed; and it is, therefore, considered a simple substance. It is grey, with a shade of red, having scarcely any taste or smell. It is soft, brittle, and yet said to be a little malleable when made red hot. As a metal it has been put to no use; but an oxide of it is employed, as we have already stated, to tinge glass blue.

Near Exeter, in Devonshire, a substance is found in great abundance, which is called the black oxide of *manganese*, and under this name is probably known to our readers. It is frequently used in various arts, and has already been several times mentioned in our pages. For a long time chemists were puzzled what to make of this mineral; some of them called it an ore of iron, and some a particular species of earth: at length Bergman showed that it was a metallic oxide; and not long afterwards Dr. Gahn succeeded in reducing it to a metallic state. He lined a crucible with charcoal powder moistened with water, put into it some of the mineral, formed into a ball by means of oil, then filled up the crucible with charcoal powder, luted another crucible over it, and exposed the whole for about an hour to a very intense heat. On opening the crucible a metallic button, or rather a number of metallic globules, was found, equal in weight to one-third of the mineral employed. This metal is manganese. It is of a greyish white colour, like cast iron, and has a good deal of brilliancy. It is softer than cast iron, and may be filed; at the same time it is brittle, and can neither be hammered into plates nor drawn into wire. When exposed to the air it soon loses its lustre and becomes an oxide. It combines readily with other metals, particularly iron, from which it is hardly ever quite free. It has been put to no use, and is only procured in small quantities by the chemical process just described.

Of *cerium*, though placed by chemical writers among the metals, absolutely nothing is known.—There is a heavy mineral called *cerites*, which has hitherto been found only in the mine of Riddarhytta, in Westmannland, in Sweden, and is of course very rare. It is found mixed with ores of copper and some other metals, and is of a rose red or flesh red colour, tinged occasionally with olive brown. It is supposed that the basis of this mineral is a peculiar metal, to which the name of cerium has been given; but all attempts to obtain it in a separate and metallic state have failed. By the experiments of some very celebrated chemists, carburets and oxides have been made; but the metal, the supposed simple, undecompoundable base, has never yet been detected.

Uranium, though almost as little known as cerium, and put to no use, has an undoubted existence. In the George Wagsfort mine, in Johan-Georgenstadt, in Saxony,

there is found a peculiar mineral, from which the celebrated chemist, Klaproth, obtained a peculiar metal, which he called uranium. It has since been detected in other substances, but is not profusely scattered throughout nature. It is of an iron grey colour, and yields to the file; it combines with oxygen; and this is all which is known of the metal uranium.

Zinc has been much longer known than either of the metals we have just mentioned, and is, consequently, a great deal better known. The ancients were acquainted with a mineral, which they called *cadmia*, which, when melted with copper, formed brass; but there is no proof that they were acquainted with zinc in its metallic state. This metal is first mentioned in the writings of Albertus Magnus, a great alchymist, who died in the thirteenth century, under the name of marcasite of gold. The word *zinc* occurs first in the writings of Paracelsus. In this country ores of zinc are found in the state of sulphurets, or combined with sulphur; and in the neighbourhood of Bristol and Swansea there are works for extracting the metal. The ore is roasted, reduced to powder, and exposed to a strong heat in large closed clay pots. The metal is gradually reduced, drops down, and flows out through an iron tube into vessels containing water. It is afterwards cast into ingots and used for making brass, or sent abroad. In England, among the workmen it is known by the name of spelter. It is of a brilliant white colour, having a shade of blue, and when rubbed by the fingers they become of a black colour, acquire a peculiar taste, and emit a peculiar smell. It is not so malleable as copper, lead, or tin; but neither is it so brittle as some metals, which will hereafter be described.

It may, by very cautious pressure, be reduced to thin plates; and formerly it was supposed that it could not be folded without breaking. It has, however, been lately discovered, that by heating and then annealing it, it continues soft and flexible, and may be bent and applied to many uses. Heated a little beyond the boiling point of water, it is very malleable, but heated to double that, or somewhat above 400, it becomes so brittle that it may be reduced to powder in a mortar. At a still higher temperature, about 680, it melts, and may be evaporated and distilled in close vessels, like water or brandy. When allowed to cool, it crystallizes like alum or any other salts. It combines readily with oxygen, being the most combustible of all the metals. In this state it is of a white colour, and is used as a paint. The ores of this metal are very extensively diffused, and it forms a large part of all those mineral substances known by the names of *calamine* and *blende*. In China there is an abundance of this metal, and it is used in a state of great purity to form the current coin of the country. It is the base of what is called white vitriol, and is employed in some places for covering the roofs of houses, making water-pipes, and other domestic purposes. We have already, (see No. 5,) had occasion to allude to the useful application of this metal, which was recommended by Sir H. Davy. By interposing a thin piece between the edges of the copper sheets with which the bottoms of ships are covered, he prevented the action of the salt water on the copper, and has made it of considerably greater durability. Zinc is also employed by chemists to construct galvanic batteries; but its chief use is in the shape of alloys with other metals, some of which are well known, and are extensively employed in the arts. Three parts of copper and two of calamine, or carbonate of zinc, form *brass;* five or six of copper and one of zinc form *pinchbeck*. *Tombac* is composed of the same materials and arsenic, but with a still larger quantity of copper: *prince's* metal, on the other hand, contains more zinc than either of the former. *Bronze* consists of the same two metals, with an

addition of tin. To make brass, the calamine is previously roasted; it is then mixed with charcoal and granulated copper, exposed in crucibles to a heat that will not at first melt the copper, but after a time the heat is increased, the copper is fused, and the compound is run into ingots. Brass is perhaps one of the most useful of all the metallic alloys. Unlike copper, it does not tarnish on being exposed to the air; is more readily melted, and is more malleable when cold. It is of great use as wire, and of it sieves of extraordinary fineness are wove, which could not be made of any other metal. It is said that the Dutch or German brass, (for the principal manufactory of this article is on the Harz mountains in the kingdom of Hanover,) possesses superior ductility to that made in England, and is on that account preferred by watchmakers and other artists. This is said to be owing to the Dutch brass containing more copper than the English. By that process called cementation, which was described under the head of "Iron," copper plates and calamine being the materials employed, the Germans make a superior kind of brass, which is hammered out in thin leaves, and sold in this country under the name of Dutch gold. It is about five times as thick as gold leaf, or about one sixty-thousandth of an inch thick. Having ourselves all the materials for making this substance, we do not see why some of our manufacturers or artists may not reach or excel the Germans; and having stated the fact in which their superiority is supposed to be founded, we must leave the proving of it, and its application, to our readers.

CHEMICAL SOCIETY.

Having received a note from A. M., of which the following is an extract, we feel ourselves called on in justice to the numerous Correspondents who have addressed us on the subject, and come forward with ardour and zeal to act on the suggestion of A. M., to state what we think should be done.

To the Editor of the Chemist.

Sir,—I this day had the pleasure of seeing in your excellent Publication, the handsome offer of Luzitanus, and I fully give him credit for the zeal he displays in behalf of the Society; but I must confess that I do not think the former part of his offer ought to be accepted. Either he must give more than the others, or all must subscribe *5l. 5s.*; and I do not think every one would be inclined to pay such a sum. I certainly think, however, that J. G., in his letter, published in No. XIII. of the Chemist, has fixed the subscription at too small a sum, although his suggestions, for the most part, are very good.

I conceived that 1*l.* paid down immediately, and 1*s.* or 1*s. d.* weekly would be a fair medium;* and I think that each member ought to pay the stipulated sum, and no more.

W. J.'s proposal of a room to carry on the business of the Society, would, I believe, be very acceptable; and I assure you, Sir, I am much flattered by the attention given to my suggestion, but still it was but a *mere* suggestion; and I by no means meant to give any further impulse to the Society except as far as my subscription, &c. goes. As to the mode of management, the appointment for a meeting, &c., I entirely leave this, Sir, to your better judgment; and I have no doubt the Members will all feel a pleasure in being guided by your experience. At the same time, I think it would be advisable for the well-wishers of the Society to meet where you may fix, on Saturday, the 19th inst.

I am, Sir,
Your obedient servant,
A. M.

The Editor must, in the first place, express his great regret that he can only promote the interests of such a Society by his little publication. Being always engaged

* Another Correspondent, A. P., has suggested 1*s.* 6*d.* per month, and a small sum at the commencement.

of an evening, and it being only of an evening that the Members of the Society propose to meet, or can meet, he must of course be precluded, however unwillingly, from taking any active or directing part in its proceedings. At the same time, it seems to him, he has now received so many communications on the subject, that there is such a number of persons willing to unite and form the proposed Society as would secure its permanent success. Sixteen gentlemen, several of them having sent their real addresses, have signified to him their wish to join the Society. This number, with the advantages offered by W. J. and Luzitanus, is ample for beginning; and nothing more seems necessary than that they should meet. A. M. proposes that the meeting should take place on Saturday, the 19th inst., which is quite impossible, because the Editor has no other means of communicating with several persons who wish to join the Society, but "The Chemist," which does not appear till that day. He would suggest, therefore, that the meeting should take place on Saturday, the 26th, at eight o'clock in the evening, at the room offered by W. J., and should any thing occur to make it inconvenient or impossible to meet on that day, he will announce it in his publication of the 26th.*

At the first meeting, probably the best mode of proceeding would be, immediately to elect a Chairman and Secretary for the night,—for the former is indispensable to preserve order, even among a very small number of persons; and without the latter there can be no record of the proceedings. A series of Resolutions should then be proposed, embracing the principle of forming such a Society, the number of persons it is to consist of, the amount of the subscriptions of each, the times of meeting, and the mode of proceeding to be adopted at each meeting. Of course, the more simple and fewer the Resolutions are, the easier they will be comprehended and the more readily assented to. Should the Resolutions be adopted, the Society will be formed; if not, a second meeting may take place; or it may be impossible to reconcile the different views of the persons desirous of forming such a Society, and thus impossible to constitute it. There can be little fear, however, of this, if each person comes to the meeting with a disposition candidly to listen to what others may say, and without too great a confidence in his own ideas of what will best promote the success of the Society.

Till the gentlemen who wish to form such a Society meet, it is quite impossible to prescribe any further rules for their proceedings, which may not do more harm than good. The object of the Society would be to prosecute in common the study of chemistry; and some individuals, possessing large means and leisure, might desire to expend more money and time in the pursuit than was compatible with the views of others. Thus, it will be observed, that there is at starting a considerable difference of opinion among those who wish to join the Society as to the sum to be paid; and all the advice we shall at present give our young friends is, to fix the subscription at the sum most suitable to the majority who attend the Meeting; and both those who desire to expend more, and those who do not wish to expend so much, may either fall into the general view, or each party may endeavour to form a Society by itself. As the Editor cannot take any part in the proceedings of such a Society, he must, like A. M., express his unwillingness to give it a particular direction, when it would be impossible for him to guide it to its aim. Without being personally acquainted with the parties, it would be presumptuous to give them advice. He always meant to limit his endeavours in favour of the Society to bringing those together who wish

* The Editor not having received the permission of this gentleman to name him, must postpone giving his address till next week.

to establish it. That, he trusts, is now in a fair way of being accomplished; and he is quite sure, the individual who first suggested forming it, and the other individuals who have entered with so much zeal into his plan, will so temper their ardour with discretion, as to conduct it, without that experience on which A. M. is pleased to compliment him, to a happy issue.

TO EXTRACT GELATINE FROM BONES.

By M. Darcet.

" After the bones have been submitted to ebullition for some hours to remove the fat, they are to be properly treated with weak hydrochloric acid, (dilute muriatic acid) which dissolves the whole of the phosphate and carbonate of lime, as well as the phosphate of magnesia, and leaves naked the pure gelatine, preserving the form of the bones, and as flexible as a rush.

" To remove from the substance thus obtained, the small portions of fat and acid which it may contain, it is exposed to a stream of cold water, which gives it whiteness and a semi-transparency. After having well wiped it with linen, it is put into baskets, and plunged for a few moments in boiling water, and afterwards in cold water again. If, notwithstanding all these precautions, the gelatine still retains any acidity, it may be put into a solution of sub-carbonate of soda, which saturates the acid by forming hydrochlorate of soda, which is easily removed by two or three washings, and indeed the presence of this salt can be productive of no inconvenience. When the gelatine has been well washed, it is to be dried on open basket-work or nets, in a very airy place. In drying it diminishes very much in volume. It is afterwards put into bags or casks, placed in a dry situation secure from dogs and cats, which will eat it greedily.

" Cut in pieces, this raw gelatine, which still keeps the form of the bones, is dissolved in a few hours in boiling water. The operation is more speedy when it has been previously steeped in cold water for five or six hours: in swelling up, it absorbs 58 per cent. of its own weight of the cold water. By putting two parts and a half of gelatine in 100 parts of boiling water, the liquor forms a jelly on cooling, without the necessity of prolonging the ebullition. By evaporation this jelly may be made thick enough to be cut out in tablets, which are dried and preserved like the raw gelatine. The latter is the most convenient in laying in a large stock of provisions; but the other is more convenient for daily use, because it dissolves more speedily.

" Under these two forms the gelatine is imputrescible, and may be kept without alteration or loss, as if it was still in the bones, where it is known to be in a great measure preserved from decomposition.

" Used as glue by joiners, &c. gelatine has a tenacity one half greater than the best Paris glue. It furnishes the manufacturers of painted papers, and painters in distemper, with a tremulous glue, perfectly colourless and less expensive than what they formerly used. Hats prepared with this substance do not become cockled or blistered by rain, a defect of all hats that are prepared with Flanders glue.

" Gelatine serves also for preparing lip-glue of the first quality, transparent leaves for tracing drawings, and sheets of factitious horn. M. Darcet has had an idea of making transparent wafers with it for sealing letters. He has manufactured some paper by grinding raw gelatine as rags are pounded, and operating with this gelatine reduced into a paste, as they do in paper-mills with common paper. By rolling or laminating the paper thus obtained, a kind of parchment is produced, which may be very useful.

" Gelatine is likewise made to enter into the composition of sulphurous water-baths, to prevent them from having that irritating action on the skin generally complained of by patients."

PROFESSOR HARE'S GALVANIC AND ELECTRO-MAGNETIC EXPERIMENTS.

(*From the Philosophical Magazine.*)

SEVEN hundred feet of copper wire, nearly as thick as a knitting-needle, were made to encircle the columns of the lecture-room. One end of the wire was connected with one end of a large calorimotor, the other terminated in a cup of mercury; into this, a wire proceeding from the other pole of the calorimotor was introduced. Under these circumstances, a magnetic needle placed near the middle of the circuit was powerfully affected; and when the circuit was first interrupted, and then re-established by removing the wire from the cup, and introducing it again, the influence appeared to reach the needle as quickly as if the circuit had not exceeded seven inches in extent. The needle being allowed to become stationary in the meridian, while the circuit was interrupted, and the end of the wire being then returned into the mercury, the deviation of the needle and the contact of the wire with the metal appeared perfectly simultaneous.

A wire was made to circulate with great rapidity, by means of two wheels, about which it passed like a band. The wheels being metallic, and severally connected with the different poles of a calorimotor, it was found that the motion neither accelerated nor retarded the galvanic influence; and it made no difference whether the needle was placed near the portion of the wire which moved from the positive pole to the negative, or the portion which moved in the opposite direction.

If a jet of mercury, in communication with one pole of a very large calorimotor, is made to fall on the poles of a horse-shoe magnet communicating with the other, the metallic stream will be curved outwards or inwards, accordingly as one or the other side of the magnet may be exposed to the jet, or as the pole communicating with the mercury may be positive or negative. When the jet of mercury is made to fall just within the interstice, formed by a series of horse-shoe magnets mounted together in the usual way, the stream will be bent in the direction of the interstice, and inwards or outwards, accordingly as the sides of the magnet or the communication with the galvanic poles may be exchanged. This result is analogous to those obtained by Messrs. Barlow and Marsh with wires or wheels.

It is well known that a galvanic pair, which will, on immersion in an acid, intensely ignite a wire connecting the zinc and copper surfaces, will cease to do so after the acid has acted on the pair for some moments, and that ignition cannot be reproduced by the same apparatus without a temporary removal from the exciting fluid.

I have ascertained that this recovery of igniting power does not take place if, during the removal from the acid, the galvanic surfaces be surrounded either by hydrogen gas, nitric oxide gas, or carbonic acid gas. When surrounded by chlorine, or by oxygen gas, the surfaces regain their igniting power in nearly the same time as when exposed to the air.

The magnetic needle is, nevertheless, much more powerfully affected by the galvanic circuit, when the plates have been allowed to repose, whether it take place in the air or in any of the gases above-mentioned.

TO CORRESPONDENTS.

Both the notes of A. D. and H. R. W. have been received. If the matter of the communications promised by the former be good, we shall not reject them on account of the language. The letter of H. R. W. will be inserted.

J. L., who requests us not to publish his letter, will see by our former Number, that we were ready to do him justice as soon as we learnt the circumstance to which he alludes.

R. C. and J. Clark, with reference to the Chemical Society, have both been received.

*** *Communications (post paid) to be addressed to the Editor at the Publishers'.*

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The Chemist.

"——Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

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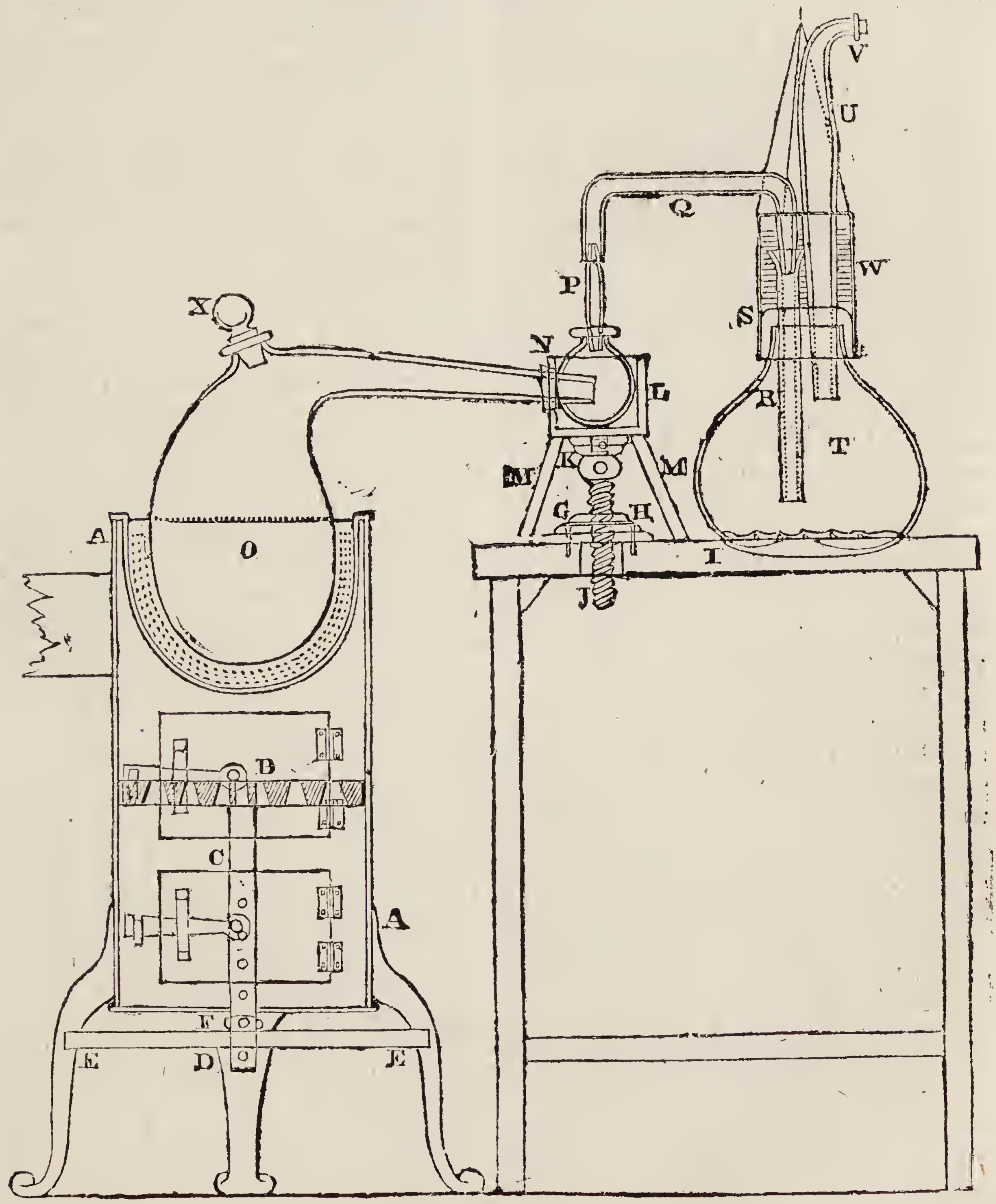

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MR. TIGERE'S IMPROVED STOVE AND CHEMICAL APPARATUS.

The contrivance of this gentleman, of which the following is a description, will be found convenient for heating sand-pots and other chemical operations.

A A is a German-stove, the body of which is made, in the usual manner, of plate iron; but with its grate, B, made moveable, so as to be raised or lowered, and retained at any required height. This is effected by means of the iron stem, C, affixed to the grate in its centre, and passing through a guide-hole, D, in the cross-bar EE, which is secured to the legs of the stove. Holes are made in the stem C; and an iron pin, F, being put through any one of them, and resting upon the cross bar EE, the grate is supported at the height required; and, on withdrawing the pin, the grate, and the fuel upon it, is lowered, and the heat instantly abated in consequence.

GHI is an improved support for a receiver, &c.; it being capable of the nicest adjustment in height, as well as sideways, by means of the screwed stem, G, which acts in a female screw, H, firmly affixed upon the table or stand, I, and passes through a hole, J, made in the table to receive it. The upper end of the screw H is made cylindrical; and is received into a cylindrical hole, made in the piece of wood, K, affixed underneath the square wooden box, L. The cylindrical head of the screw has a groove or channel made around it, to receive a pin, which is affixed in the piece K, so as to prevent it from coming off the cylindrical head, and yet allow it to play around it. A hole is also made through the screw, near its head K, through which to pass a pin or lever to turn it by, so as to elevate or depress the box L, and adjust it to the greatest accuracy; and far more conveniently than can be done by the use of wooden blocks of various heights or thicknesses, and as generally recommended in chemical works.

The exact position of the box, L, having thus been found, it is to be afterwards retained in its place either by means of the stays MM, or otherwise.

This box, L, has an opening made in its side, to receive one of the two necks of the receiver, N, into which the beak of the retort, O, is fitted by grinding; and into its other neck the short tube, P, is fitted. This tube has one arm of the double-curved tube, Q, fitted upon it, by grinding; and its other arm is received into an upright tube, R, which passes through, and is secured in a perforation made in a thick cap of glass, S, which may be either ground to fit air-tight upon the top of the large receiver, T, or be cemented upon it. U is a safety-tube, of a peculiar shape; which is also ground air-tight into an aperture made to receive it, in the glass cap, S. This safety-tube may be four feet or more in length, as recommended by Dr. W. Lewis, in his article "On assaying gold," and it has its upper end, V, bent at a right-angle, and *loosely stopped* with a small cork, so as to readily open, in case of any undue pressure being exerted within the receiver, T. W is a kind of bag, or cistern, made of a piece of oil-skin, sewed together at its edges, and securely bound around the outside of the glass cap, S. Its use is, to hold water, to cool the gaseous matters distilled over, previous to their entering the large receiver, T; as well as to prevent the loosening of the cement by the heat, when the glass cap, S, is so secured to the top of that receiver. The bag, W, is supported by four strings affixed to the rim of it, and affixed to a nail, &c. above it; and the safety-tube, U, is also to be secured above, in a proper manner.

The whole apparatus described was used by its inventor for various chemical operations, and particularly for making the chlorate of potash, of which he could prepare two pounds per day, by charging the retort with the usual materials for generating chlorine;

four several times. The large receiver, T, was a black glass carboy, such as are used to hold sulphuric acid; and it contained three gallons of the solution of potash. It was firmly secured to the table, I, by being let into its top, and cemented; and, indeed, excepting the removal of the glass stopper, X, of the retort, and of the safety-tube, U, to charge and discharge those vessels, (the latter of which operations was performed by means of a syphon,) the whole apparatus remained undisturbed during its use. He commenced the operation without employing much heat; but, in order to get off the most of the gas, the sand in the bottom of the bath required to be heated to about 300°. He ascertained this degree, sufficiently near for his purpose, by plunging a common gardener's thermometer into the sand, up to the mark for summer-heat; and when the mercury rose to 220°, it indicated that the lower part of the bath had attained the required degree of temperature.—*Technical Repository.*

CHEMISTRY AS A SCIENCE.
Art. XV.
CADMIUM. LEAD.

There is a little anecdote connected with the history of the first of these metals, which we think is worth telling our readers. On the continent of Europe, where the governments, whether beneficially or not we shall now neither inquire nor decide, take a much greater number of precautions for the benefit of their subjects than our government takes, each country or district is placed under the superintendence of medical men and of chemists, whose business it is to attend to the health of the people, and see the apothecaries drug them according to the most approved method. If a man wants to poison himself there, he must get the permission of the government or a prescription from a physician; for otherwise, as we ourselves have experienced, when we were shaking with an ague, not a drop of laudanum nor a grain of arsenic can be procured. Some years ago, when a counsellor Roloff, under the orders of the Prussian government, was inspecting the apothecaries' shops in the district of Magdeburg, he found a preparation of zinc, which he confiscated, on the supposition that it contained arsenic. Like a good servant of the state, he drew up an account of this circumstance, and had it published in one of the medical journals of the day, to the great injury of Mr. Hermann, from whose manufactory this preparation of zinc had come. Mr. Hermann, on this, subjected the oxide of zinc to a close examination, but could detect no arsenic in it, and counsellor Roloff, after having confiscated the apothecary's stock, and injured Mr. Hermann, was brought to repeat his experiments, and to confess that what he had taken for *orpiment* contained no arsenic, and was indebted for its peculiarities to a different metal. Professor Stromeyer had previously ascertained the existence of *cadmium* in some ores of zinc, and on this new metal being sent to him, he recognised it to be cadmium. Since he made chemists acquainted with this substance, it has been found in the Derbyshire silicates of zinc, and in the zinc works near Bristol. It has never been obtained in great quantities, nor put to any specific use. The process by which it has been procured at Bristol, is as follows:—When calamine is subjected to a strong heat, with charcoal, for reducing the zinc, the flame is first brown, and this colour is owing to the presence of cadmium. At present, the workmen do not establish the connexion between the crucible in which the calamine is put and the vessel to receive the zinc, till this brown flame is succeeded by a blue one, which arises from the zinc. An oxide of cadmium is, however, found attached to the roof of the crucible, or clay pot, mixed with soot, sulphuret of cadmium, and oxide of zinc. By dissolving this substance in muriatic acid, filtering, evaporating

to dryness, redissolving, filtering, and then precipitating by a plate of zinc, the metal cadmium is obtained. It is afterwards mixed with lampblack, or wax, put into a black or a green glass tube, and placed in the red heat of a common fire, until the cadmium has sublimed in the cool part of the retort. The residuum is then to be shaken out, a little wax introduced into the tube, and a gentle heat applied, when the sublimed metal again melts, and forms a button. Cadmium thus obtained, resembles tin in its appearance, but is somewhat harder. It stains paper or the fingers, is ductile and malleable; it is very fusible, and may be melted by touching it with a red hot iron wire. It is converted into vapour at a temperature a little higher than the boiling point of mercury. By exposure to the air, it is scarcely susceptible of alteration, but does, in course of time, become a little tarnished. As we have already said, it has been put to no use, and is of no other importance than that it has yet defied the chemist's art to reduce it to any other elements, and is therefore considered as a simple substance.

We have no doubt that many of our readers will be somewhat surprised to learn that the substance, Lead, with which they are so familiar, is also considered as an element. Like iron, lead has undergone the operations of the chemist, or metallurgist, who can effect no further alteration in it. Lead is not a product of nature, but of art, though the ores from which it is obtained are plentifully scattered in various parts of the world. In Britain it is found abundantly in Scotland, in the hills of Northumberland, Durham, and Derbyshire; and in other countries it seems equally plentiful. It is chiefly obtained, however, from a very common mineral, called red glance, or galena, and which is a sulphuret of lead. The ore, after being brought from the mine, is *hand-dressed*, or all the substances which can be separated by the hand are taken away. It is then washed, and afterwards put into a reverberatory furnace, where it is speedily made red hot; in this state it is frequently stirred, and when it begins to be soft, the heat is reduced, till the whole of the sulphur is expelled. The fire is then increased, the lead is melted, and sinks to the bottom. A little lime is then thrown in, to thicken the scoria, and the lead is drawn off into oblong moulds. By the further application of heat to the scoria, more lead may be obtained, but it is not considered so good as that obtained by the first operation. We need not describe the appearance of this substance to our readers; it is one of the softest of metals, is very malleable, but, though it may be drawn into wire, it is not very ductile, and is not very tenacious. It is unelastic; not sonorous, like most other metals; and, however bright it may be, when exposed to the air it soon loses its lustre, becomes first of a dirty grey colour, and at length almost white. This is owing to its gradually combining, like iron, with oxygen, and being converted into an oxide. When a very strong heat is applied, the metal boils and evaporates, and if cooled slowly it crystallizes. Water does not act on lead of itself, but it facilitates the action of air, the same as dampness facilitates the action of air on iron. Hence, when water is kept in leaden vessels, there is always found a white line on the sides just at the spot where it reaches, which is occasioned by the lead being oxidized there. When lead is kept melted in an open vessel, its surface is soon covered with grey oxide; when this is removed another succeeds, and by continuing the operation the whole of the lead may be converted into this substance. This is usually called dross. All the oxides of lead, however, are very easily reduced to the metallic state by heating them with a mixture of tallow and charcoal, or with any substance that will absorb the oxygen.

Lead has been long known and

used, both in its metallic state and in its combination with oxygen. Ever since the time of Moses, and how much before it is impossible to say, lead has been in use, and has continued in use from that time till the present day. The Romans, we are told, sheathed the bottoms of their ships with it, and fastened it on with bronze nails. It seems at that time not to have been so easily obtained as at present; for there is reason to believe the Romans had no tin but what was imported from Britain, and yet lead was twenty-four times as dear as at present; whereas tin was only eight times. Lead is at present very extensively employed, and in so familiar a way that it is quite unnecessary for us to state the number of uses to which it is put. There is one, however, not so familiarly known, depending on a chemical property of lead, which we shall describe—we allude to its use in refining other metals:—

The oxides and ores of lead are easily converted into a sort of glass, and in this state separate other substances from gold, silver, and platinum, which are thus purified. This process is called refining when conducted on a large scale, and cupellation, from the name of the vessel, when conducted on a small scale. The process differs in some measure, according to the nature of the ores; but in England the *cupel*, or refining vessel, is composed of six parts bone ashes and one fern ashes, made into a paste with water. In the centre of this there is a shallow cavity for the reception of the metal, and at one end there is a hole for the escape of the *litharge* formed during the operation. When the cupel is heated, the metal, being a mixture of lead and silver, is put in through an aperture in the furnace, and a stream of air is made to play on it, by which the litharge is formed, and escapes along a groove in the cupel to the hole where it is to flow out. As this groove is destroyed by the action of the substance, the litharge is made to run along another, and in this way the whole of it is withdrawn. The silver remaining in the hollow cavity is again subjected to a similar process, and is then run into ingots. If nothing was present but lead and silver, the substance called *litharge*, well known to medical men, who use it to make an embrocation, is formed and consists of an oxide of lead, combined with carbonic acid; if other metals were present, and the process was intended to separate them, they remain mixed with the lead, and to obtain either them or the litharge, another operation must be carried on. This property of lead, of easily fusing and combining with other substances, is the reason for generally employing it in the refining both of silver and gold. In fact, most of the ores of lead contain silver; and when the latter is in sufficient quantity to pay the expense of separating it, the separation is effected in this manner.

The substance called white lead, and so well known as a paint, is made by exposing thin sheets of lead to the action of vapour of vinegar, which gradually converts it into a white powder. The manufactory of this substance is carried on very extensively in England, France, and Germany, and has lately been very much improved. It was formerly supposed that this white powder was a peculiar oxide of lead; but it is now known that it owes its peculiarities to the presence of carbonic acid, and that it is a salt or carbonate of lead. In this state it was used by the ladies of Rome even for a cosmetic; and there is abundant reason to believe, much as we hear of the beautiful simplicity of savage man, that it is only in the very highest state of civilization when both sexes find their enjoyment in the charms of nature. The Hottentot and the Esquimaux besmear themselves with grease; the woolly-headed African and the copper-coloured Indian disfigure their faces with hideous slashes; the ladies of Rome formerly, and the Circassians of our day paint them-

selves habitually; while in the crowded cities of Europe, people, as the rule, are contented with washing themselves; and nobody paints but a few *antiques*, anxious to assume the airs of youth, or a few debauchees, who claim by gas-light the appearance of beauties. It is a very philosophical and correct remark, therefore, that it is only in the highest state of civilization man listens to the voice of nature, and permits his physical powers to be fully and freely developed. Lead is also used combined with glass, particularly with the glass of which achromatic or colourless telescopes are made. Acetate of lead is largely employed in dyeing, and this is made by dissolving oxides of the metal in pyrolignous acid. Red lead is, probably, also known to our readers, as it is extensively employed as a paint; this is the red oxide of the metal, and is made by exposing a substance called *massicot*, the yellow oxide of lead mixed with metallic lead, to the action of heat.

The alloys of lead with other metals are very useful. With one proportion of tin it forms pewter; and in a still greater proportion it forms soft solder. With antimony it enters into the composition of printers' types; and it forms part of *white metal* buttons. There are a number of other alloys made with lead, and a number of other uses to which the metal is put; in all, however, care should be taken that it is not swallowed, and that the dust is inhaled as little as possible. Lead in almost all shapes is a poison, producing a painful disease, called, from the persons who mostly suffer under it, the *plumbers' cholic.* Notwithstanding this deleterious effect, it was formerly largely used for preserving wines from acidity; and it is to be feared that some dealers at present, less careful of the health of their fellow citizens than anxious to fill their own pockets, continue to make use of this poison. We know, too, that the red lead is sometimes used for colouring articles of food; and one of the valuable uses of chemistry consists in enabling persons to detect such poisons, and to point out remedies for the diseases they induce.

FIRING GUNPOWDER.

To the Editor of the Chemist:

SIR,—If your Correspondent in No. XIV. had made himself at all acquainted with the science of electricity, he would have known that it requires a much better conductor than a wooden table to complete the circuit to discharge the jar; he would also have seen the impropriety of fastening the wire, C, to the brass upright in the jar, as in the diagram, as by that means the electricity would pass down the glass tube at every turn of the machine without ever entering the jar.

Having made the experiment of firing gunpowder myself, several times, I will, with your permission, endeavour to give a more correct description of the method of using the apparatus than your Correspondent. He has described a small plate of metal, to which a piece of chain or wire is attached, to be fastened to the bottom of the jar; on this plate a small quantity of powder is to be placed; a glass tube is to be prepared similar to that shown in the plate, only having a ball on the top of it about an inch from the cork, instead of the long wire there described.

Having now given the jar as high a charge as it will bear, apply the wire at the bottom of the tube to the powder on the plate, and with the other hand place one knob of the discharging rod on the top of the tube; bring the other in contact with the knob on the jar, and the explosion immediately takes place.

Sir, I remain
Your obedient servant,
NO PHILOSOPHER AT ALL.

POISONED LOLLYPOPS.

WE are by no means sure we have spelled the last word of our title right; for though we were accustomed, many years ago, largely to indulge our inclination for sweets, by sucking lollypops, and though the word then sounded very smooth-

ly to our ears, we do not recollect having met with it in print, and we are afraid our lexicographers, with a barbarous neglect of the delights of children, have forgotten to settle its orthography. We shall therefore, we hope, be excused by our youthful readers, if our mode of writing this pleasing word should be different from theirs. Having thus apologized for our error, if we have committed one, we now come to the important part of our subject, which is to warn all mothers, as well as their offspring, against poisoned lollypops. Little did we think, when we sucked and grinned with sugary satisfaction, so that our besmeared face, which is now so complacently smoothed by editorial wisdom and admonition, looked like the representation of some Indian god, that we were infusing cholics, spasms, and stitches into our blood, to give us years of agony for one moment's joy. It is, perhaps, well for the old woman with whom we used to change our pence for pops, that she is gone to answer for all the pain she inflicted on us, or, as we understand there is no law to punish her for paining us, we are not quite sure we should not hasten to take revenge, (as incurable patients sometimes revenge themselves on doctors,) by making her swallow her own confectionary. We are glad, however, that we are saved from this violence; and we would have our young readers avoid the possibility of being incited to commit an action of this description, by abstaining from eating all poisoned sweetmeats. We have long known, from very high authority, that there was "death in the pot."* A proverb, too, which we believe may be found in most European languages, says that cooks are all agents of his Satanic majesty; and now it appears that confectioners, brewers, bakers, wine merchants, grocers, &c. &c., all belong to the same army, and are engaged in a destructive warfare against human life. If it had not been for the great discovery of Mr. Malthus, we should have never ceased wondering that there was any body left alive to record the woes to which we are doomed by nature, and which are inflicted on us by art as soon as we are out of our cradles. There is positively no wholesome food but mother's milk. Our greatest joys, too, are most deleterous. There is poison in sweetmeats for the child, poison in the cup of love for youth, poison in the wine-cup for old age, and poison in all our meats and drinks for all sexes, ages, and conditions. The chemist, unfortunately, has no test for the most bitter of all poisons, that in the cup of love, which being of a moral nature, needs a moral antidote. His art can furnish a test for some poisons; and though the necessity to live, or eat, constantly hurries people on to death, and he can by no means stop their course, he can sometimes enable the victim to know by what dart he falls. If the boy leaves his coloured sugar-plums, and takes to bread, there he finds alum tightening and corroding the fibres of his stomach, and without escaping pain, is made sooner old. If, terrified by the arsenic with which wine is clarified, the man takes refuge in beer, he is then dosed with *coculus indicus* or *nux vomica;* and if he then resolves to drink nothing but water, he finds it contaminated with lead in almost every town in Europe, and can nowhere drink it pure but as it is formed from snow in the mountains of Switzerland, and there it produces that most hideous of all maladies, cretinism. There is, as we said before, no wholesome food but mother's milk; and if the fountains whence it springs were never dry, we might be, if not always young, at least always children. But as this is not in nature, the CHEMIST must do what it can to make people aware of their danger, and teach them resignation, by showing them that their fate, though susceptible of some little amelioration, is inevitable. We lately had occasion, in consequence of some persons having

* 2 Kings, ch. iv. 40.

been made ill, to point out a test for copper in sweetmeats; and we are now called on by the following statement to point out a test for lead in lollypops:—"One penny-worth of red balls, called, we believe, Nelson, or Waterloo Balls,—there were no such fine names in our lick-finger days,—yielded on analysis 30 grains of an indissoluble matter resembling red-lead, which on being fused with the blow-pipe produced 24 grains of lead in a metallic state. We wish," says the author of this notice, which is taken from the *Stockport Advertiser*, "to impress upon the minds of parents the necessity of strictly charging those to whom they occasionally entrust the care of their children, not to purchase for them sweetmeats of this description, since it cannot be doubted that the use of these deleterious compounds has in many instances produced injurious effects on the system, which nothing could ever eradicate." There is, in fact, no other way of escaping poison but not to eat; and we join the Editor of the Stockport Advertiser in cautioning parents not to suffer their children to be unnecessarily poisoned. They must not eat sweetmeats; but as it is to be apprehended they will, in spite of our caution, we shall perhaps do them some service by putting them in the way of ascertaining if their sugarplums contain poison, and by suggesting to those who use lead for colouring them the use of a substance which will answer the same purpose without being quite so virulent a poison.

We have already described—(see p. 227,)—the mode of producing sulphuretted hydrogen gas; let this be combined with water in the following manner:—In the first place, it must be received in a bottle placed over the pneumatic trough, or a common basin, as described in p. 9, No. I. of the Chemist. After the gas has been thus collected, cork the bottle while its mouth remains under water, and remove it, and then place it inverted in a cup containing distilled water; in a few hours, the water will have ascended considerably up the bottle, and this water will be impregnated with sulphuretted hydrogen gas. In water thus impregnated, and slightly acidulated with muriatic acid, put the colouring matter of the sweetmeats, when, if it contains lead, the impregnated water will shortly assume a dark brown or black colour. The impregnated water should not be made very long before it is used, as the hydrogen will quit the sulphur, which is then precipitated in the form of a white powder.

A very fine red may be made of cochineal, as recommended in various cookery books, for the colouring of jellies; but as this may be too expensive, and as children are not particular as to shades, we recommend pastrycooks to slice beet-root very thin, to boil and strain it, and use the liquid, which will give a deep red colour to their sweetmeats. In fact, there are so many comparatively harmless and cheap modes of colouring paste of every description, that not only are we surprised any body should give himself the trouble and go to the expense of poisoning children, but we know not which of these numerous methods most to recommend. There is no excuse, however, for using lead; and most certainly he who puts it into his plums deserves not to be dealt with.

ANSWER TO QUERIES.

To the Editor of the Chemist.

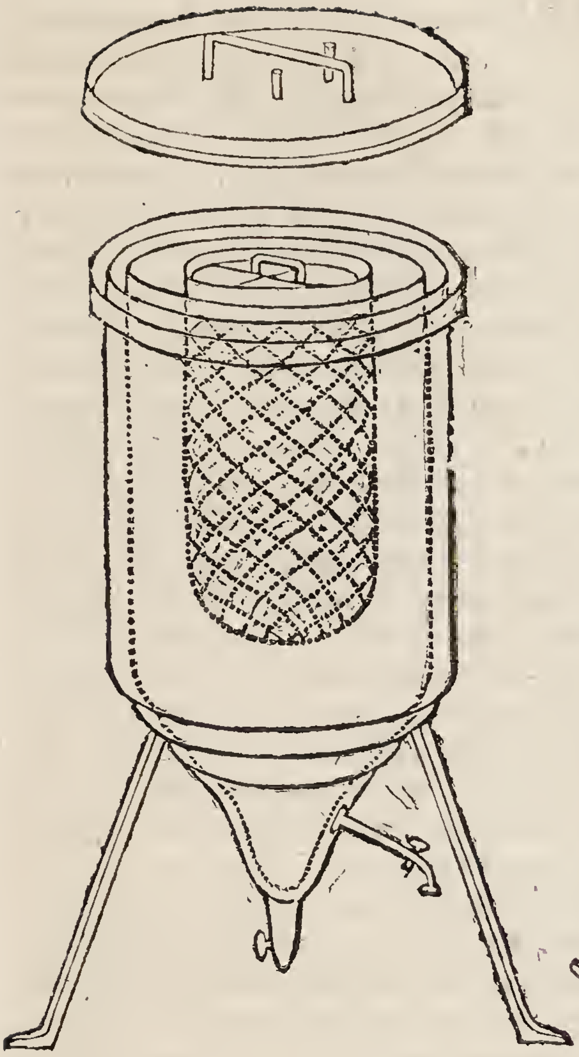
Sir,—In reply to the Query of your Correspondent H. S., inserted in No. XIV. of your valuable publication, "The Chemist," I beg to suggest the following method of making a durable ink, which writes pale, but becomes black on drying.

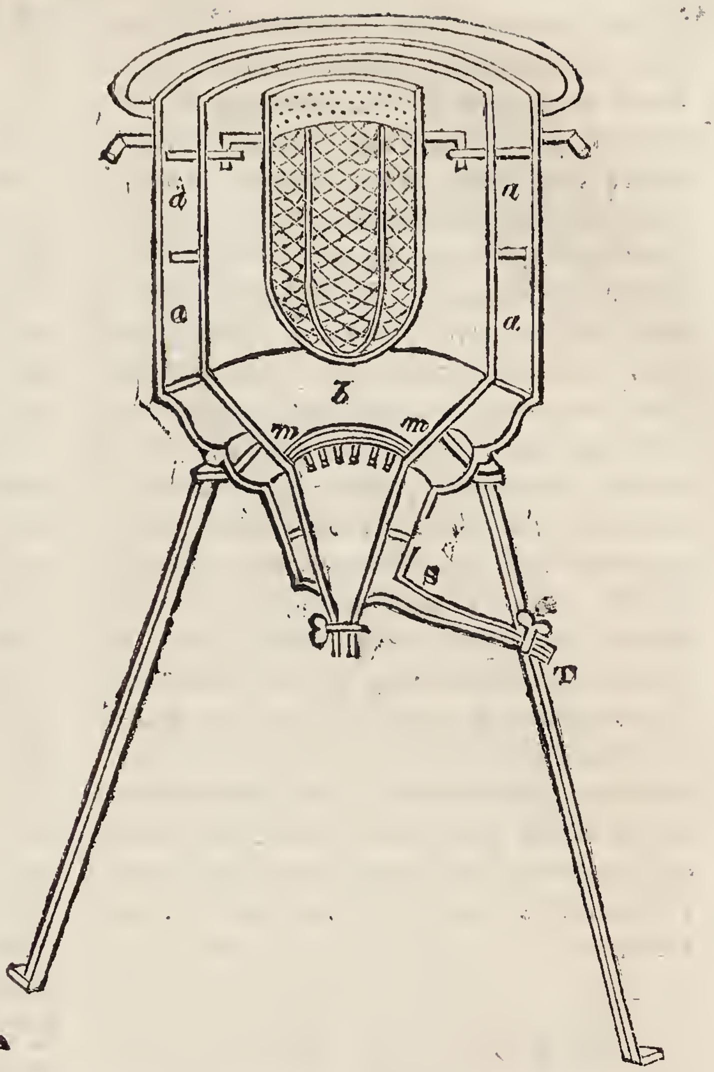
J. E. K.

Mix together in a quart wine measure of spring water, cold—

2 oz. of Aleppo galls, bruised,
1 oz. of green copperas,
1 oz. of gum arabic,

And shake them twice a day for ten days, when it will be fit for use.





CHEMICAL APPARATUS.

CALORIMETER.

Our plate represents an instrument contrived by the two celebrated Frenchmen, La Place and Lavoisier, to determine the *specific* heat of bodies. It is called a *calorimeter*, or measurer of heat, but is neither a very correct instrument, nor of great utility. Some very interesting experiments were, however, made with it, and some curious conclusions drawn from them, by these two celebrated Frenchmen, at a time when the theory of *heat* was very imperfect, and much studied; which make us think we shall do our readers no disservice by giving them a representation of the instrument. It was constructed on the fact, that the heat of a hot body surrounded by ice does not pass through the ice, but is all employed to melt it; and as Dr. Black and others had previously ascertained, that a certain quantity of heat was necessary to convert ice into water, the quantity of ice melted by the heat of the inclosed body, it was concluded, would be the measure of the quantity of heat which escaped from it, and in this manner that the relative specific heat of all bodies thus examined might be ascertained. The calorimeter consists of three vessels, inclosed one within the other; the innermost of which, *b*, to contain the substance submitted to experiment, is a cage made of iron wire, covered by a lid of the same materials. The middle vessel, or cavity, contains the ice, which has under it a sieve, or grating, *m m*. As the ice is melted, it runs through this and through a conical funnel into a receiver placed below. The external vessel, *a a*, is also filled with ice, to prevent the effect of the air and other surrounding bodies. The water produced from it is carried off by another pipe, S T, so as not to mix with the water from the first. When the machine is to be used, the outer and middle vessels are closely filled with pounded ice, and the substance submitted to experiment is placed in the inner vessel, and instantly covered. When the body has cooled down to the freezing point, the water is carefully weighed, and is supposed, taking

it for granted that a certain quantity of heat has been necessary to form each drop, to measure the quantity of heat which has escaped from the body to bring it to the freezing point of water. On the late Mr. Wedgewood attempting, however, to repeat the experiments of the French chemists, the water which ran from the ice froze again; and as it does not seem possible to obviate this, at least not without exposing the water to heat from some other source, the calorimeter is, as we said before, neither an accurate nor a convenient instrument. The freezing is occasioned by the evaporation of the water, and as it has been shown that this is always greatest at the temperature of 32°, which is about the temperature of the water, a very slight diminution of temperature by evaporation will cause the melted ice again to freeze.

MONUMENT TO MR. WATT.

The public Meeting on Friday, June 18, to open a Subscription for the purpose of erecting a Monument to the late James Watt, promises to have so much influence on the future prosperity and character of the community, that, although it is not our business to keep a record of public events, we can by no means pass by this one in total silence. The Meeting, as our readers are most probably aware, was called by some of the first men of the land, and was attended by many noblemen, men of science, and men of business, among whom were the following distinguished individuals:—The Earl of Liverpool, *First Lord of the Treasury;* the Earl of Aberdeen, *lately his Majesty's Ambassador at Vienna;* Mr. Peel, *Secretary of State for the Home Department;* the Hon. Mr. F. Robinson, *Chancellor of the Exchequer;* Lord Bexley, *formerly Mr. Vansittart, and Chancellor of the Exchequer;* Mr. Huskisson, *President of the Board of Trade;* Sir J. Mackintosh, *one of the leaders of the Opposition;* Mr. Brougham, *another of these leaders;* *Admiral* Sir Isaac Coffin; Mr. Wilberforce, M.P.; Sir Humphrey Davy, *President of the Royal Society;* Mr. Bolton, *son of Mr. Watt's late partner;* Mr. Wedgewood, *the porcelain manufacturer;* Mr. Turner, *a great canvass manufacturer;* Dr. Birkbeck, *the President of the Mechanics' Institution*, &c. &c. Of course the resolutions were unanimously adopted; and the sum of sixteen hundred pounds, of which his Majesty gave five hundred, was immediately subscribed. The work thus happily begun will, no doubt, be successfully completed; and ere long a monument to James Watt will be placed in one of our national temples, as a memorial of his stupendous genius, and of our gratitude to that Power which made him the instrument of bestowing almost immeasurable benefits on the whole human race.

Mr. Watt was not only a mechanic, he was also a chemist; and we are proud of the opportunity to hold up the honours bestowed on him, as an encouragement to our youthful readers. As was happily explained at the Meeting by Sir Humphrey Davy, Mr. Watt's "discoveries were not owing to chance, but were founded on delicate and refined experiments connected with the discoveries, as to heat, of Dr. Black. He was equally distinguished (he said) as a natural philosopher and a chemist;" and his first important discoveries were made in chemistry; and his first important invention was an application of chemical principles to steam-engines. His great mechanical improvements in them only began at a later period. In 1769, he took out a patent for lessening the consumption of fuel in steam-engines; and it was not till 1780 that he found the method of applying the movement of the pistons in straight lines to wheels and mill work. We have already, in our account of Bleaching, mentioned Mr. Watt as one of the great improvers of that process, and as having been instrumental in applying the use of chlorine to bleaching on a large scale. In fact, his peculiar merit appears to have consisted in a

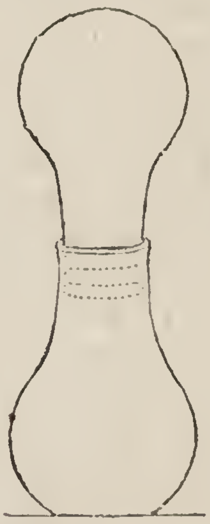
steady application of the discoveries of science to the purposes of life. He was not bred a philosopher but a man of business, having his way to make in the world; and it deserves to be remarked, that the guiding motive for his exertions was a clear view of his own interest. It was his pride to make useful discoveries; and all his inventions tend to improve or adorn life. His character as a *man* was fully equal to his reputation as a mechanist and a chemist. Both the Earl of Liverpool and Mr. Brougham bore testimony to his private worth. The latter said, nothing "could be more pure, more candid, or more scrupulously loving of justice than Mr. Watt." He was distinguished, too, by a total want of jealousy of other scientific men, and by the greatest amiability to all his friends and relations. In short, he was admired in the world for his genius, and loved in his family for his virtues. His kindness, his benevolence, and his humanity spread a lustre over his mechanical and chemical pursuits; and the vast influence of his inventions made his amiable qualities more lovely. His character was one of the most splendid examples we know of a union of gentleness and strength; of the greatest moral beauty combined with the highest degree of intellectual power.

Certainly, therefore, no other individual could have been selected more deserving national honours, and from honouring whom more permanent benefit will accrue. At any period, and done in any manner, this circumstance would have had most beneficial effects; but now, when there exists such a facility of making all public events known that the whole people of this empire, like the inhabitants of the ancient Greek republics, live, as it were, within hearing of one another, and when the manner of adopting these resolutions was so public and dignified, the results will be doubly beneficial. Mr. Watt was not a warrior, over whose victories a nation may mourn, doubtful whether they have added to its security, and certain they have diminished enjoyment and abridged freedom. His were the conquests of mind over matter; they cost no tears, shed no blood, desolated no lands, made no widows nor orphans, but merely multiplied conveniences, abridged our toils, and added to our comforts and our power. The good policy of erecting monuments to mere warriors, who combat at other men's bidding, careless of right, and only greedy of honours and emoluments; who enforce the observance of a creed and defend freedom of worship with the same zeal, and who are as ready to support oppression as defend liberty, which has hitherto only been a matter of doubt in philosophic minds, will become, by the example of this Meeting, the general sentiment. Henceforth men will perceive the folly of encouraging the shedding of human blood; will recognise the wisdom of uniting glory with usefulness; and will only erect monuments to those in whose labours there is no alloy of misery and mischief. It is the consecration of this sentiment, by the presence of the statesmen of all parties; who unfortunately have in general only taken the lead when restrictions were to be imposed, industry depressed, or wars encouraged, that makes us look on the public Meeting to erect a monument to Mr. Watt as an event which, in its result, will be one of the most remarkable of the present period. In fact, for men to provide for their own interest and their own comfort seems so natural, as to need no encouragement. Statesmen therefore have not, in general, bestowed any marks of approbation on those who have most successfully cultivated this part of all men's business. The present, we believe, is the first instance where they have thought it necessary to confer honours on a man who was fortunate enough, in the avowed pursuit of his own prosperity, to add to the happiness and greatness of his country.

We have before said, that the

guiding motive of Mr. Watt, in all his applications of the principles of science to the purposes of life, was a clear view of his own interest. He is distinguished from other public benefactors, by never having made, or pretended to make it his object, to benefit the public. He was not a political quack, or a religious charlatan, who pretends to live and act only for others, but a man occupied with the care of his own fortune; and we have the united testimony of all the great and distinguished persons who were present at the Meeting, that this unpretending man in reality conferred more benefit on the world than all those who for centuries have made it their especial business to look after the public welfare. It is the holding up such a man, actuated by such motives, to the admiration of the public, that we regard as the circumstance most peculiar in this case; and we should be wanting in our duty to our youthful readers, if we did not press this on their attention, and caution them against supposing, because Mr. Watt has obtained public honours for public services, that the object of their exertions should be the benefit of that public.

It is plain that the faculties of every man are only calculated to promote his own happiness; and the example of Mr. Watt shows that he is the best citizen who pays the closest attention to his own interest. It sets in a clear point of view the principle which has often been theoretically, but not effectually urged, that the only means of promoting general good, is for each individual, as nature dictates, to attend to himself. Honouring the man who has done this, argues a sane mind in the public; and the proceeding having received the sanction of our rulers, the opinion will become fashionable. It is the first severe and effectual blow which has ever been given by authority, to all those moral *quacks* who, with sense and intellect no more expanded than other individuals, assume something like the character of divinity, claim a right to make laws for the rest of the world, and pretend to guide their actions with a view to universal good. In every point of view, then, the erecting a monument to the humble mechanic, the working chemist, the self-interested James Watt, marks, in our opinion, a salutary epoch in the history of the human mind, which will lead to consequences not likely to be forgotten, and certainly not foreseen by those who honoured the Meeting by their presence.



TO MAKE A SOLID OUT OF TWO INVISIBLE GASES.

To the Editor of the Chemist.

Sir,—You showed your readers, in No. XII., how to perform this experiment; but there is another method of performing it, which is easier, and quite as amusing. It is as follows: — Take two wide-mouthed decanters, as represented in the subjoined sketch; pour a very small quantity of muriatic acid in one, and liquid ammonia into the other, just sufficient, when rinced round, to moisten every part of the inside of the glasses. If these decanters be kept at a distance from each other, they will appear empty; but invert one within the other, as seen in the plate, and they will both be filled with dense white vapours, like clouds, and at length a crystallized crust will be formed on the inside of the glasses, which is muriate of ammonia.

I am, Sir,
Your obedient servant,
Simplicitas.

USES OF NITROGEN.

To the Editor of the Chemist.

Sir,—Observing in your little Publication, page 108, the subject of Nitrogen, I wish to make a few remarks, which may not prove uninteresting to your readers.

You say, we are as yet ignorant of the utility of this gas in constituting so large a portion of the atmosphere; the mode of its operation; and that it is the oxygen alone that disappears in respiration and combustion. It has been, you will allow, most satisfactorily proved, that oxygen *only* breathed, caused a laborious and hurried respiration, and is incapable *long* of supporting animal life; if so, why doubt for a moment whether or not *oxygen* (*Query*, azot?) be inhaled, and inform me how it is supplied, to be emitted in such large quantities in the decomposition of all animal substances. In my experiments I have proved, and therefore agree with Mr. Troussett, that the gas emitted from the skin is pure azot; and as, in vegetables, it combines with carbon, hydrogen, and a small portion of oxygen, to form oil, wax, resin, &c. so in my opinion does it combine with the same substances, though in different proportions, to form the *fat*, *gelatine*, and *muscular* fibræ of all living animals.

H. R. W.

OBSERVATIONS ON SOME MASSES OF IRON FOUND ON THE EASTERN CORDILLERE OF THE ANDES.

(*By Messrs. Mariano de Rivero and Boussingault.*)

On arriving at Santa Rosa, a village on the road from Pamplona to Bogota, we were informed that a mine of iron had been discovered in the neighbourhood, and that a fragment of this mineral was used by the farrier of the village for an anvil; but we were agreeably surprised when we discovered that the supposed mineral was a mass of iron full of vacuities of an irregular form, and having all the characteristics of meteoric iron. This mass was found on the hill of Tocavita, half a mile from the village, to the eastward, on Holy Saturday, in the year 1810, by Cecilia Corredor. We repaired to the spot, and saw the excavation which it was necessary to make to get out the mass, for it was almost buried, a single point of some inches only appearing above the surface. The hill of Tocavita, as well as the land about Santa Rosa, consists of a sand stone of the secondary formation, which is there of a considerable extent. Santa Rosa is about twenty leagues to the north-east of Bogota, in 5° 40′ lat., and 75° 40′ long. west of Paris, and 2744 metres above the level of the sea. The inhabitants of the village all united their efforts to fetch this mass of iron down; it remained eight years at the municipality, and was afterwards for seven years made use of by the farrier.

The iron, though full of holes, did not any where contain signs of being covered with a vitreous cake or varnish. It was malleable, granulated, easily filed, had a brilliant white colour, and its specific gravity was 7.3. This mass contained 102 cubic decimetres, and consequently must have weighed about 750 kilogrammes, upwards of 1640 pounds. At the same time that this mass was discovered, a great many fragments were also found at different other parts of the hill; and during our short stay in that neighbourhood, we collected several small pieces. We analysed a portion of the large mass in the following manner:—A piece, weighing 1 gramme 28. of this mass having been thrown into nitric acid, was rapidly dissolved, leaving only a very small residuum; we then evaporated nearly to dryness; in order to oxidate the iron sufficiently, water was then added, and a precitate produced by ammonia. The oxide separated by the filter was washed in warm water; the ammoniacal liquid was tinged green; and the prussiate of potash produced a precipitate of a light green, which indicated the presence of nickel and not of copper. When this ammoniacal solution

was reduced to the half of its volume by evaporation, we added caustic potash to it; and, to be certain of the entire decomposition of the double salts of ammonia and nickel, we evaporated to dryness. Water was added to the residuum, and the oxide of nickel which we obtained, washed, and calcined, weighed 0.14. By treating the oxide of iron obtained with acetic acid, a further proportion of 0.01 of nickel was obtained. Thus the elements of this substance are oxide of iron 1.17, oxide of nickel 0.15; or 100 parts contain 91.41 iron, 8.59 nickel. The authors then give an account of the analysis which they made of several other meteoric masses of iron, and they found in all of them about 8 parts in the 100 to be nickel. In some of the stones they found a small portion of insoluble matter, which they conjecture to be a mixture of iron, nickel, and perhaps chromium.

DICTIONARY OF CHEMISTRY.

Anatase. A very scarce mineral, found only in Dauphiny and Norway, remarkable for showing a variety of colours by reflected light.

Anatto. A pigment obtained from the seeds of the *bixa orellana*, a tree cultivated in America and the West Indies, used in dyeing and colouring cheese.

Andalusite. A massive mineral, of a flesh colour, first found in Andalusia, in Spain, whence its name.

Andreolite, *harmotome*. Cross-stone.

Anhydrite. A species of gypsum, the *marmo bardiglio* di Bergamo of statuaries; it takes a fine polish.

Anil, *nil*. The plant from the leaves of which indigo is prepared. It grows in America.

Animals, chemically considered, are chiefly composed of azot, carbon, hydrogen, and oxygen; and with these, phosphorus and lime—forming the bony parts, sulphur, soda, magnesia, iron, &c., are frequently found combined in variable proportions. The analysis of animal substances is as yet very incomplete and imperfect, but is now prosecuting, particularly in France, with considerable success.

Anime, *gum anime*. A resinous substance, brought from America, used by perfumers, and by surgeons, to form plasters, which have been thought beneficial for nervous affections of the head.

Annealing. A process somewhat analogous in principle to tempering metals. Its object is to render substances, otherwise brittle, tough; and it is usually performed by cooling them gradually after they have been heated.

Annotto, *anatto*.

Anthracite. *Blind coal, Kilkenny coal, glance coal.* A peculiar coal, which yields neither flame nor smoke, and leaves whitish ashes behind.

Anthranothion. A name given by M. Von Grotthus to the supposed base of sulphocyanic acid.

Antimoniates. Compounds of antimonic acid and different bases.

Antimonic Acid, *peroxide of antimony*.

Antimonious Acid, *deutoxide of antimony, argentine flowers of antimony*.

Antimonites. Compounds of antimonious acid and different bases.

Antimony. A peculiar undecompounded metal. The *antimony* of commerce is an ore consisting of sulphur and this metal.

———, butter of, *chloride of antimony*.

———, hydrosulphuret of, *kermes mineral*, formerly a very celebrated medicine.

Ants, acid of, *formic acid*.

Apatite, *phosphate of lime*. A mineral found in the tin mines of Cornwall and other places.

Aphlogistic Lamp. A lamp which burns without flame, invented by Sir Humphrey Davy, and employed by miners, it being an addition to the safety lamp of the same illustrious chemist.

AN ARTIFICIAL VOLCANO.

Mix together two parts of nitrate of zinc and one part of subacetate of cobalt, and expose the

mixture to the heat of a spirit lamp in a small glass globe with a short neck, or in a platina spoon. The mixture soon becomes liquid, and seems at first of a rose colour, then purple, then blue, and in an instant it catches fire, detonates, becomes dry, and of a fine green. The product spreads over the glass like small rolled up leaves of tea. A single sheet of paper will receive the whole of the eruption of the crater of this mimic chemical volcano.

ERRORS AMONG THE MASTERS; OR, DR. THOMPSON AND M. VAUQUELIN.

To the Editor of the Chemist.

SIR,—Some of your readers who are deep in the study of chemistry may thank me for the following translation of some observations of M. Vauquelin, the celebrated French chemist, on a passage in Dr. Thompson's System of Chemistry. They are contained in the *Annales de Chimie et Physique* for April 1824.

I am, Sir,
Your obedient servant,
CRITICUS.

In Thompson's System of Chemistry, says M. Vauquelin, p. 311, (the passage is to be found at p. 273, vol. i. sixth edition,) it is stated:—"When electric sparks are passed through phosphuretted hydrogen gas for some time, the phosphorus is deposited, and pure hydrogen gas remains; but the volume of the gas is not altered by this process. Hence it follows, that phosphuretted hydrogen gas consists of hydrogen gas holding a quantity of phosphorus in solution. This quantity is discovered by subtracting the specific gravity of hydrogen gas from that of phosphuretted hydrogen." Further on, at p. 275, he says:—"Hydrophosphoric gas may be procured by exposing phosphuretted hydrogen to the direct rays of the sun. A quantity of phosphorus is deposited, and the gas changed into bihydroguret of phosphorus. When sulphur is sublimed in this gas, the volume is doubled, and two volumes of sulphuretted hydrogen gas are formed." An effect which, according to the same author, continues M. Vauquelin, takes place when potassium is heated in it. From this the conclusion is drawn that bihydroguret of phosphorus is composed of two volumes of hydrogen gas united to the same quantity of phosphorus as exists in one volume of phosphuretted hydrogen gas, and these two volumes are condensed into one. There is in this, as is very evident, a manifest contradiction. If phosphuretted hydrogen gas consists of hydrogen gas holding a quantity of phosphorus in solution, without being condensed, and if this gas is converted by the effect of the sun's rays, or by electricity, into bihydroguret of phosphorus without changing its volume, it is evident that the latter is also a solution of phosphorus in hydrogen, without condensation, and that there is no difference between these gases but in the quantity of phosphorus. In fact, in order to make the second part of the reasoning of Dr. Thompson correct, the phosphuretted hydrogen gas should be condensed to the half of its volume in becoming bihydroguret of phosphorus, which, according to Dr. Thompson's own statement, does not take place. This would be the first time, probably, that hydrogen gas was ever seen to condense its volume in parting with a solid body which it held in solution, though the contrary is frequently met with. It is, however, of some consequence to ascertain if the volume of the bihydroguret is doubled when sulphur is sublimed in it; for as it is ascertained that sulphuretted hydrogen gas contains a volume of hydrogen equal to its own volume, it must be admitted, that if the volume of bihydroguret was doubled by the sulphur, it must contain two volumes of hydrogen gas condensed in one; but this does not happen, as will be seen by what follows: — Experiment 1st. One hundred measures of phosphuretted hydrogen gas, exposed for some days to the influence of the sun, deposited phosphorus, and ceased to take fire in the air; the volume

was not sensibly diminished 1-50th part. I supposed that this gas, thus exposed, was decomposed, when, on allowing bubbles of it to escape through the mercury, it did not burn; it appeared, however, that it was not entirely decomposed, for, some time afterwards, having lifted up the bell-glass, in which it was contained, suddenly, it caught fire, and deposited a good deal of sulphur. Ex. 2nd. One hundred measures of phosphuretted hydrogen gas were heated with sulphur; their volume increased about 1-10th, and they were converted into hydrosulphuric acid gas.—Ex. 3d. One hundred measures of bihydroguret of phosphorus having been heated with sulphur, were decomposed, and changed into sulphuretted hydrogen gas, but they did not sensibly alter their volume more than about 4½ measures.—Ex. 4th. One hundred and twenty-five measures of phosphuretted hydrogen gas, mixed with distilled water, and placed in a dark situation, were speedily decomposed; the phosphorus was deposited, and the gas no longer took fire in the air. The diminution of volume was 1-25th. Ex. 5th. Phosphuretted hydrogen gas placed in contact with distilled water, and exposed to the cold produced by mixing ice and salt, was speedily decomposed, though in a dark place. Water and cold, then, promote more actively than the sun, the decomposition of phosphuretted hydrogen. This decomposition cannot be attributed to the presence of air in the water; for its volume is not sensibly diminished; besides, this gas is little soluble in water. These experiments prove that phosphuretted hydrogen gas and bihydroguret of phosphorus are simple solutions of phosphorus in hydrogen gas, without its being condensed; for the small augmentation of volume which took place in melting sulphur in bihydroguret of phosphorus is of no consequence; besides, this augmentation takes place in both. Thus these two gases contain volumes of hydrogen gas equal to their own volumes, and only differ in the proportion of their phosphorus.

CHEMICAL SOCIETY.

The Editor hopes that the present notice, though late, will not prevent any of the friends of the Chemical Society from attending the proposed Meeting. He has received W. J.'s permission to name him, and his assent to the meeting taking place at his offered room. As before announced, therefore, those gentlemen who wish to form among themselves such a Society, will have the goodness to meet at Mr. Jones's, No. 55, Great Prescot-street, at eight o'clock on Saturday evening. The Editor must again express his own regret at being unable to attend, more particularly as he has been requested by a country Correspondent to make known the regulations adopted in such a Society. At the same time, he will be happy to make the Chemist the vehicle for submitting to public perusal any of the proceedings of the Society which he and they think worthy of publication.

QUERY.
ON THE PURIFICATION OF WATER.

To the Editor of the Chemist.

Sir,—Could you, or any of your Correspondents, inform me of a receipt for purifying water which contains iron? By giving me an answer in some following Number you will greatly oblige,

June 12. A. B. D . . . y.

TO CORRESPONDENTS.

Juvenis, *and James Marsh, in our next.*

We have unfortunately mislaid the communication of Another Dairy Maid, *or it would have appeared in the present Number. We feel we do not deserve any further favours, but knowing that* woman's *charity is always greater than* man's *failings, we hope we shall hear from her again.*

*** *Communications (post paid) to be addressed to the Editor, at the Publishers'.*

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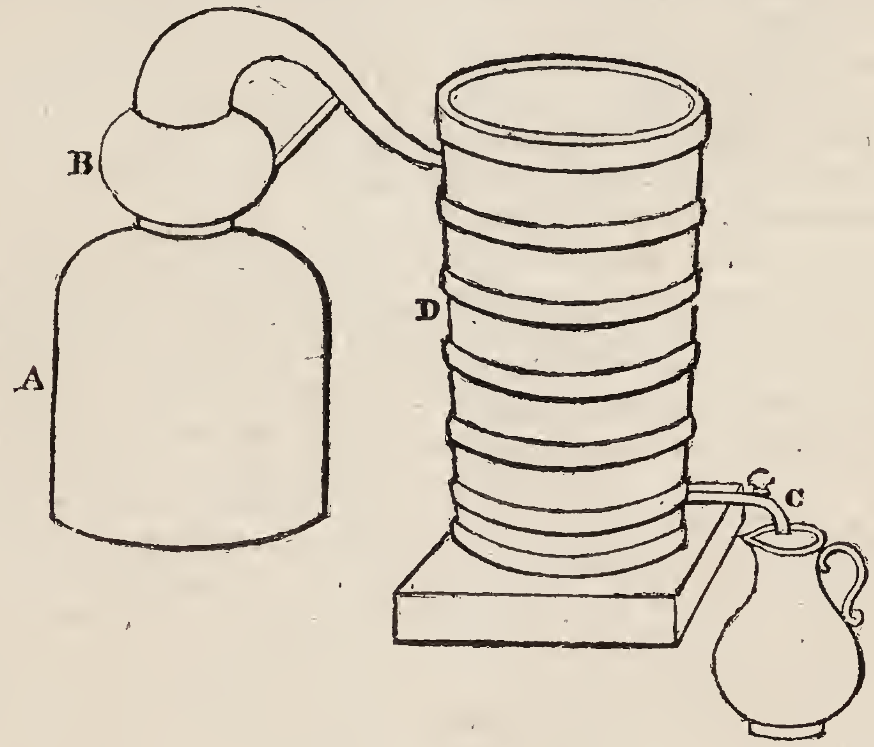
The Chemist.

"—— Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. XVII.] SATURDAY, JULY 3, 1824. [Price 3*d*.



CONTENTS.

CHEMICAL APPARATUS.

Description of the Plate.

Our plate represents a form of still now in use for the distillation of ardent spirits; but it is not that form we can recommend, when the still is only allowed, as in Germany, to be taken out of the custody of the excise officers for 24 hours at a time, and if wanted for a longer period, must have the leave renewed every 24 hours; or when, as in Britain, a duty is exacted in proportion to the time the

still is at work. To meet both these cases ingenuity has contrived another kind of still, of which we shall hereafter give a representation. The present is an old fashioned and common still. *a* is the body, and *b* the head. The spirit or volatile product, as it rises from the material subjected to heat in *a*, is carried up to *b*, whence it is transmitted into a pipe coiled spirally in the tub, *d*, and called the worm, and terminating and coming out of a hole in *d*, at *c*. The tub is filled with cold water, and the volatile product in its passage through the spiral tube is condensed and flows out at *c*, as a fluid, into whatever is placed to receive it. As we intend shortly to enter fully into the principles and practice of distillation, we shall now say no more on the subject.

DICTIONARY OF CHEMISTRY.

Aphrite, *earth foam, schaumerde.* A species of carbonate of lime, found in Thuringia and the north of Ireland.

Aplome. A variety of the garnet; a mineral of a deep orange brown colour.

Apparatus. We only give this as a chemical word, because in some authors the whole of the contents of a laboratory is described under it.

Apyrous, *refractory.* Bodies which resist the action of heat, or are unaltered by it, have been called Apyrous; but the term *refractory* is at present most generally used.

Aqua-fortis, *strong water, nitric acid* in a weak and impure state. It is called single and double, as it is weak or strong, and when much concentrated is distinguished by the name—*spirit of nitre.*

Aqua Marine, *beryl.* A precious stone.

Aqua Regia, or Regis, *nitro-muriatic acid.* A mixture of these two acids, formerly so called from its great solving powers.

Aqua Vitæ, *low wines, ardent spirit of the first distillation.* A general name for all strong drink, the words signifying "the water of life."

Aqueous, *watery.*

Aquila Alba, *aquila mitigata, mercurius dulcis, calomel, mild muriate of mercury.* A combination of muriatic acid and mercury, employed as a medicine.

Arbor Dianæ. An amalgamation of mercury and silver, made by mixing a solution of *chloride of silver* in ammonia with running mercury.

Arcanum Duplicatum, *vitriolated tartar.* A salt very early known, to which a variety of names have been given; now generally called sulphate of potash.

Arcanum Tartari, *secret foliated earth of tartar, essential salt of wine, regenerated tartar, diuretic salt, digestive salt of Silvius;* now *acetate of potash.*

Archil, *lichen rocella, archilla, orseille.* Properly speaking, *archil* is the name of a purplish-red dye, prepared by grinding the *lichen rocella* between stones, so as to bruise but not pound it, and then moistening it with urine mixed with lime. In a few days it becomes of a purplish-red, and is then called *archil*, and at length of a blue colour, and then it is called *lacmus* or *litmus*. It is a costly dye, and is seldom used by itself, as it is very fugitive, except with marble, to which it is said to impart a durable and beautiful violet colour. Litmus is employed in chemistry to make a test paper, and is then improperly called *tincture of turnsole.* The plant from which the archil is made is a whitish *lichen*, and grows at the Canary and Cape de Verd Islands, and in the south of France.

Ardent Spirit, *alcohol, spirit of wine.*

Areometer. An instrument for measuring the specific gravity of fluids.

Argal, *argol, bitartrate of potash, crude tartar.* A substance deposited on the inside of wine casks.

Argentate of Ammonia, *fulminating silver.*

CHEMISTRY AS A SCIENCE.

Art. XVI.

TIN. COPPER.

Both these metals are so generally in use, that their appearance, and most of their properties, must be well known to our readers; we shall, therefore, only advert to such facts as they are most probably not so well acquainted with. The ores of tin have been found and worked chiefly in England, in Germany, and in South America; and they occur only in that description of mountains which geologists call primitive, from supposing them to be the most ancient parts of the world. In England, the ores of this metal are found chiefly in Cornwall, and from that part of the country our whole supply is obtained, and some sent abroad. After the ore is extracted from the mines, it is cleansed by the hand as much as possible; it is then reduced to powder in a stamping-mill. This consists of a large cistern, or other contrivance, such as large shelves laid on a slant, and stampers or heavy beams, armed at the ends with iron, and which are moved upwards and downwards by a water-wheel. A stream of water passes through the cistern or over the shelves; and as the ore is bruised by the stampers the water washes away all the lighter parts, and leaves the metallic part of the ore free from earthy substances. Great attention, however, is necessary in performing this part of the operation, and also in placing the vessels into which the water flows, so that the heaviest substance is left behind. When the tin ore has been thus pulverized and cleansed, it is roasted in a reverberatory furnace to drive off the sulphur, a part of which, however, is acidified, and unites with the copper and the iron generally contained in the ore. It is then again washed, mixed with one-fifth of its weight of culm, and thrown again into a furnace for about six hours, which reduces the oxide of tin, and the metal collects at the bottom of the furnace. It is afterwards drawn off into a shallow pit, where it is freed from the scoria which cover it, and is then taken out with ladles and poured into moulds. It is again exposed to a gentle heat, and the purest part which melts first is drawn off, and forms grain tin; the remainder contains a small portion of iron, copper, and arsenic, and is called common tin. What is denominated *stream tin stones* in Cornwall, being found in a state of powder, is melted in a somewhat different way. After being washed it is passed through wire sieves, it is then thrown with charcoal into a blast furnace, in which it is reduced to the metallic state and flows out below. It is afterwards fused in an iron pot, and purified by the addition of pieces of charcoal. When it appears bright like silver, it is judged to be pure, is drawn off into moulds, and forms good grain tin. In this manner the industry and ingenuity of man extracts from the apparent rubbish which he has brought from the bowels of the earth this useful metal.

The means of procuring tin seems to have been known from the most remote antiquity; for we find both Moses and Homer mention it, and both the coins and the weapons of the ancients were made of an alloy of tin and copper. At present it is not employed for either of these purposes. The discoveries of art have so improved the manufacture of iron and steel, that weapons are in Europe now made exclusively from them; and the greater durability of gold and silver, as well as their greater value, which renders a much less quantity of them necessary, have entirely superseded the use of tin as a coin. In its metallic state at present it is principally employed for covering sheet iron to prevent its rusting; to form plumbers' solder, speculum pewter, boilers for dyers, worms for rectifiers' stills, and many other utensils; as also for coating the inside of copper and iron vessels, and other similar purposes. What is usually called tin, however; that substance of which pots, pans, &c. are made, is,

in fact, iron coated with tin; and the process by which this is done is as follows:—The iron is rolled into very thin plates, which are thoroughly cleaned by being rubbed with sand, and by being immersed for 24 hours in water, acidulated by muriatic acid. They are then heated in an oven to remove the scales that may be attached to them, are afterwards hammered smooth, and are again immersed in an acid solution; they are then dipped one by one in melted tin, which not only adheres to the surface but penetrates the metal completely and gives it a white colour. Tin is further employed as a material of bell-metal, bronze, brass for cannon, and a variety of other well known alloys.

Pure metallic tin, of which there are two kinds, called block tin and grain tin, does not, however, differ in colour from the tin which forms the covering of the iron sheets. We should probably here remark, as it is common to describe a particular kind of sheet tin by the name of block tin, that we do not mean this which consists of iron sheets tinned, but the metal as it is run into blocks. In this state tin is chemically described as a white metal of great brilliancy, emitting a particular smell when rubbed; not very ductile, but very malleable, as it is beat into leaves only one-thousandth part of an inch thick, and might be made thinner if wanted; it is very flexible, and produces a remarkable crackling noise; it is harder than lead and not so hard as gold; it melts at a temperature of 442°, but it requires a violent heat to cause it to evaporate. It forms alloys with most of the metals; and what is singular, when alloyed with lead, the compound is harder and and possesses more tenacity than tin, the hardest of the two. These qualities are greatest when the alloy is composed of three parts of tin and one of lead. Like most of the other metals, tin combines readily with oxygen, and forms two oxides, one of which, the yellow oxide, is found in commerce under the name of putty, and is used for polishing glass; the other is used in forming the opaque kind of glass called enamel.

Copper, like tin, has been long known, and was even more employed than it in the times of the Greeks, and in still more remote antiquity. At present it is chiefly procured in Cornwall and in Anglesea in Britain, in Germany, and in Hungary. The ores from which it is obtained are sulphurets, or contain sulphur, and they are thus treated:—In Cornwall the ore, broken into small pieces, is roasted, being frequently stirred, in a furnace having a long chimney to carry off the sulphur and arsenic; it is then put into a small furnace with a little lime, and fused. The impurities collect on the surface, and are raked off, from time to time, into oblong moulds; they form hard masses when cold, and are used as building materials; the copper flows out through a hole in the lower part of the furnace. Fresh quantities of the ore are put in from time to time, and the process is kept up for a considerable period. To free the metal from the arsenic and sulphur with which it is still mixed, it is heated in a furnace, and then suspended in a well through which a stream of water runs. During these processes the slag collects on the surface of the metal, but as this contains copper, it is again thrown into the furnace with fresh ore. The copper is kept at a low red heat for two days, and is then repeatedly fused and cast into small moulds. Lastly, it is put with a small quantity of charcoal into a refining furnace and is again fused, when if it bears the hammer, it is fit for sale. When the fused copper is run into moulds, the purest part of it rises to the top, and may be easily separated from the rest. In Anglesea the ore, after being reduced to fragments, is put into a kiln, the flues of which terminate in a close chamber, where the sulphur obtained from the roasting the ore is condensed. Here the roasting is kept up for months together. In Hun-

gary the process is nearly similar, but the copper is fused with about one-twelfth of its weight of lead; and the impurities which it separates are removed as they formed. To ascertain when the impurities are all removed, the workman takes out a little of the melted metal on the end of a smooth iron rod, and if the metal be pure, it falls off when the rod is dipped in cold water. When the impurities have been removed, the metal is allowed to cool, and when about to become solid, a wet broom is drawn along its surface, which converts a thin layer instantly into the solid form. This is as instantly removed and plunged into water, which gives it a fine red colour. The process is repeated till the whole is formed into thin sheets; and these are the copper sheets used in the arts. Copper is also procured from those waters which contain sulphate of copper. Pieces of iron are put into the water; they unite with the sulphuric acid, and copper is precipitated. When the iron is all dissolved, the matter deposited is raked out and fused. This process is said to have been discovered by a workman accidentally dropping a shovel in such waters, which, after laying there some time, was found covered with copper. Copper is of a peculiar reddish brown colour; it has a styptic and nauseous taste, and when the hands are rubbed over it they acquire a disagreeable smell. It is harder than silver, and is very malleable, very ductile, and possesses great tenacity. At a degree of heat considerably below ignition, the surface of a piece of polished copper is covered with various stripes of the prismatic rays, the red of each stripe being nearest the most heated end of the copper.

This curious effect is probably owing to the oxidation of the metal, the oxide being thickest where the heat is greatest. A greater degree of heat oxidates it rapidly, so that thin powdery scales form on its surface, which may be easily rubbed off; at the same time the flame becomes of a beautiful bluish green colour. Copper melts at a heat nearly the same as is requisite to melt gold or silver, and then is also of a bluish-green; by a more violent heat it may be made to boil and assume the form of vapour. If allowed to cool slowly, it crystallizes, or ranges itself in a determinate manner. It does not burn till it is exposed to a heat more than sufficient to melt it, but in a stream of oxygen gas it burns with a blue flame. It does not burn, however, so easily as iron; and is not liable, like it, to fly off by collision in fragments which catch fire; it is, if we may so speak, a much safer metal, and is therefore employed instead of iron to make hoops for powder barrels, and for various other purposes, wherever powder is manufactured or used. The poisonous nature of this metal is well known; and great care should be taken, wherever copper vessels are used for culinary purposes, to keep them thoroughly clean, and never to allow any thing to cool in them. Copper rusts, or becomes covered with a green crust, by exposure to the air; but this process goes on slowly, and the crust, which is very thin, protects the remainder of the metal from further corrosion. This crust is an oxide of the metal combined with carbonic acid gas.

The uses of copper are so numerous and familiar, that we shall not enumerate them. We have already mentioned several of the alloys, such as pinchbeck, bronze, and gun metal, of which it forms a part, and therefore we only think it necessary to add, that gun metal is generally formed of about 100 parts of copper and 10 or 12 of tin. Its oxides are employed in enamel painting, and are manufactured into several colours.

TO OBTAIN LIQUID SULPHUROUS ACID.

Pass sulphurous acid gas, obtained by the ordinary methods, first through a tube filled with pieces of chloride of calcium, (muriate of lime,) and then into a ma-

rass, surrounded by a mixture of two parts of ice and one part sea-salt. Sulphurous acid is thus liquefied completely under the pressure of the atmosphere, and at a temperature not lower than 18° to 20° of the centigrade thermometer, or from 0° to 4° of Fahr. It is then transparent, inodorous, and heavier than water. At 14° Fahr. it boils, but may be preserved liquid for a long time, without having recourse to pressure, because the part which is converted into vapour absorbs so much caloric as to preserve the remainder below its boiling temperature. Poured into the hand, it produces the most intense cold, and is completely evaporated.

TO CONVERT WATER INTO ICE.

Pour some of this sulphurous acid into water; one part is converted into vapour, another dissolved by the water, but as the water begins to be saturated, the acid collects in drops at the bottom of the vessel, like an oil heavier than water. If it be touched with a tube, or rod, it is converted into a vapour, and occasions a species of ebullition; the temperature of the water sinks, and its surface is covered with a coat of ice; and the whole of the water may be frozen by adding the acid in proper quantity.

TO PRODUCE AN EXCESSIVE DEGREE OF COLD.

Surround the bulb of an air thermometer with cotton; dip it into sulphurous acid, and then allow the acid to evaporate spontaneously in the air. By making the experiment at the temperature of 10° centigrade (45° of Fahr.), a diminution corresponding to —57° of centigrade (or —72° of Fahr.,) takes place; and if the thermometer is placed in the vacuum of an air-pump, the temperature is reduced to —68° of centigrade, (or —91 Fahr.) It must be observed, however, that only an air thermometer can be employed to indicate this low temperature with accuracy.

TO FREEZE MERCURY.

Cover the bulb of a thermometer with cotton, pour over it sulphurous acid, and swing it in the air; in a few minutes the mercury becomes solid. This is effected more rapidly by putting some mercury in a small cup, pouring over it a small quantity of the acid, and placing the whole in an air-pump, from which the air is to be exhausted.

SIMPLE MEANS OF LIQUEFYING GASES.

It seems to us that the above experiments, which we have translated from a paper by M. Bussy, in the *Annales de Chimie et Physique* for May 1824, are of some importance. The late experiments of Sir Humphrey Davy, on the condensation of the gases, give us reason to suppose that it is only necessary to discover a cheap and ready method of producing that condensation, to arm the hand of man with another power as great, if not greater than steam, and attended with less danger. M. Bussy has applied this method of producing a great degree of cold to liquefy other gases which it is more difficult to condense. He begins by drying the gas to be condensed by passing it through a tube containing chloride of calcium, to which is attached another tube, bent at right angles. The horizontal branch of this latter has a small ball, which he covers with cotton, and sprinkles with sulphurous acid; the vertical branch is plunged into mercury. As the gas passes the ball, it is condensed into a liquid. By this means M. Bussy has liquefied chlorine, ammonia, and cyanogen; the latter was obtained solid and crystallized. He proposes to try, by the cold produced by evaporating these latter, to liquefy those gases which have hitherto resisted the art of the chemist.

TO PREPARE FULMINATING MERCURY.

(*In answer to a Correspondent.*)

A Correspondent has particularly requested us to inform him how this substance is prepared; and as he states this knowledge will be of considerable importance to him,

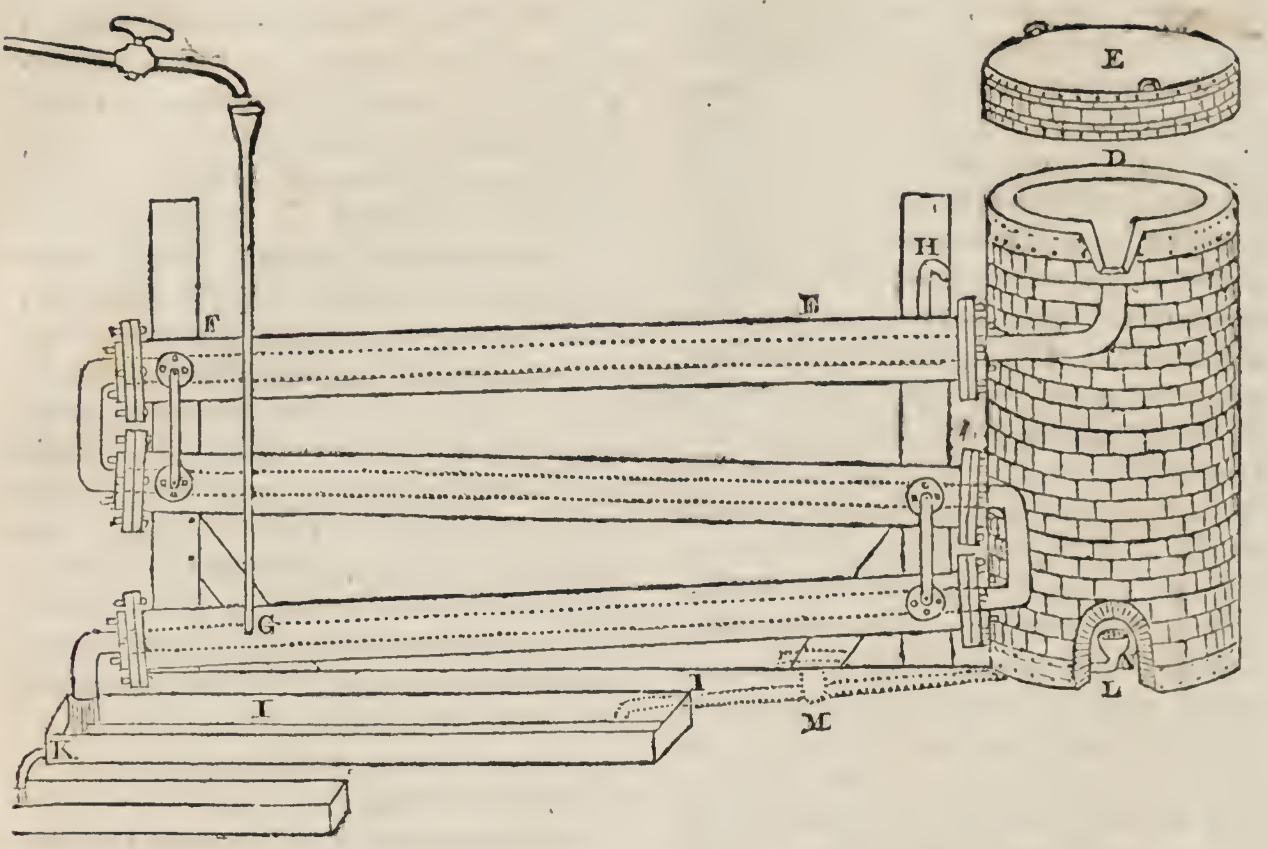
we shall not delay answering him. At the same time, we must confess that other Correspondents have a prior claim on us; but having published their queries, we still are in hopes some of our readers will answer them. If we do not soon receive some satisfactory answers, we shall answer the queries ourselves. The discovery of fulminating mercury was made by Mr. Howard, and his process is still recommended by the most celebrated chemists, and was followed by Messrs. Gay Lussac and Leibig, in their late experiments. It is as follows:—Dissolve 100 grains of mercury in an ounce and a half by measure of nitric acid, of the specific gravity of 1.3; add to the mixture two ounces by measure of alcohol, or pure spirit, and apply heat to the flask containing the mixture till it begins to boil; then remove the flask from the lamp. The action becomes violent, and continues for some time; a dense white smoke issues from the vessel, which is heavier than air. At first a little nitrate of mercury is deposited, but this is soon redissolved, the liquid becomes grey, from the reduction of a part of the oxide of mercury; after some time it becomes yellow, and crystals appear, which augment on cooling. They are of a greyish white, hard to the touch, and heavy. They are to be separated from the liquid by filtering; to be washed in pure water, and dried in a heat not exceeding 212°. By being dissolved and crystallized two or three times, they become brilliant, white, and silky, and have a faint metallic lustre. We must caution our readers how they meddle with this substance, as it detonates if heated to upwards of 300°, by the blow of a hammer, by friction, and by electricity. Indeed, as the French chemist, from whom we took the former article, observed, it detonates if struck or agitated with glass rods; and therefore the greatest precaution is necessary, both in preparing and using it. When it detonates, its effects are very violent, but they do not extend far.

AN INFALLIBLE BAROMETER.

Put two drachms of pure nitre and half a drachm of chloride of ammonia, reduced to powder, into two ounces of spirit of wine, or pure alcohol, and place this mixture in a glass tube, ten inches long and eight lines in diameter, the upper extremity of which must be covered with a piece of skin or bladder, pierced with small holes. If the weather is to be fine, the solid matters remain at the bottom of the tube, and the alcohol is as transparent as usual. If rain is to fall in a short time, some of the solid particles rise and fall in the alcohol, which becomes somewhat thick and troubled.—When a storm, a tempest, or even a squall is about to come on, all the solid matters rise from the bottom of the tube, and form a crust on the surface of the alcohol, which appears in a state of fermentation. These appearances take place 24 hours before the tempest ensues; and the point of the horizon from which it is to blow is indicated by the particles gathering most on the side of the tubes opposite to that part whence the wind is to come.

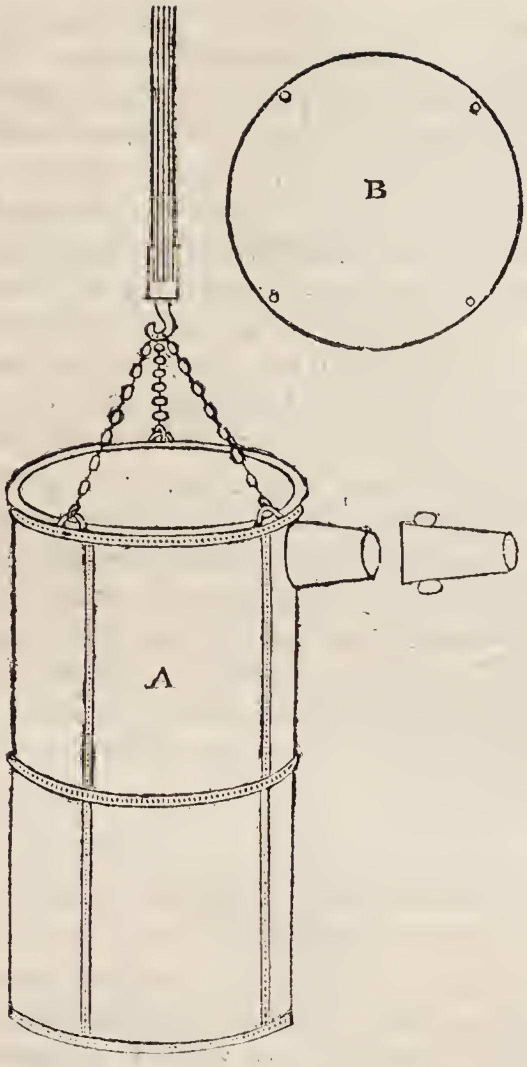
TO BLEACH ROSES AND OTHER FLOWERS.

As this is the season when flowers are plentiful, our readers may easily put the following to the test of experiment. Sulphurous acid destroys most vegetable colours, but the blues are reddened by it previously to being discharged. Flowers of a blue colour may, therefore, by the action of this acid be converted to red, and all the reds may be made white. The action of sulphurous acid may be obtained by burning a common brimstone match. Thus, hold a rose over its blue flame, and the colour will be discharged wherever the flower comes into contact with the acid, so as to render it beautifully variegated, or altogether white. If it be dipped into water, after a season the redness will be restored.



MANUFACTURE OF PYROLIGNOUS ACID.

The extensive uses to which this acid is now put will, no doubt, make a short account of the mode of preparing it on a large scale acceptable to our readers. We have, therefore, taken the following description from a French work, at present in the course of publication, entitled *Dictionnaire Technologique, &c.* The art of making pyrolignous acid is founded on the power of heat to decompose vegetable substances, and arrange their elementary parts in a different manner from that in which they existed in the body subjected to the operation. The proportion of the products varies not only from employing different substances, but they are different when only one substance is employed, according as the heat is greater or less, or the operation is differently managed. When a vegetable substance is distilled in close vessels, at first the water comes over which existed ready formed, and then water formed by a union of the oxygen and hydrogen of the substance. Afterwards a quantity of carbon is separated, and by the continued application of heat, this unites with the oxygen and hydrogen, and forms an acid, formerly supposed to be a particular acid, and then called pyrolignous acid; but it is now known to be the acetic acid united with empyreumatic oil and bitumen. As the proportion of carbon becomes greater, the empyreumatic oil rises somewhat brown, and grows thicker and darker, augmenting in density as the quantity of carbon increases. At the same time a small quantity of carbonic acid gas, much carburetted hydrogen, and, towards the close, a great quantity of gaseous oxide of carbon are disengaged. All the carbon not carried off in these various forms remains in the still, and generally preserves the form of the vegetable substance employed. Since we have learned the nature of all these products, the process has been much improved, and particularly by charring the wood, and by turning the other products to advantage. In the forests the wood is first charred, so as to dissipate all the water of vegetation. It is then introduced into a large circular or square pot, A, made of iron plates rivetted together, and having at its upper part a small lateral iron cylinder; an iron cover, B, is closely fitted to this pot, and then it is lifted by means of a crane, or other mechanical power, and placed in the fur-



nace, D, of the same shape as the pot, and the furnace is then covered with a lid, E, constructed in masonry. A moderate heat is then applied to the furnace; at first the vapour of the wood is dissipated, but this vapour soon ceases to be transparent and becomes sooty. At this time a tube or cylinder, enclosed in another of brick-work or tiles, is affixed to the lateral cylinder, and forms the condensing apparatus. This is different in different places; in some the condensation is effected by the air, the vapour being made to pass through a long extent of cylinders, and sometimes of casks adapted to each other; but most generally the condensation or cooling is effected by water, when it can be procured in sufficient quantities. The most simple apparatus for this purpose consists of two cylinders, F E, enclosed one within the other, and having between them a space sufficient to allow a large quantity of water to flow backwards and forwards and thus cool the vapour. These cylinders are adapted to the distilling apparatus, and placed inclined to the horizon. To this first apparatus a second, and sometimes a third is adapted, and placed in a zig-zag form, in order to occupy as little space as possible. The water is made to circulate in the following manner:—At the lower extremity, G, of the condensing apparatus, there is a tube which ought to be somewhat higher than the upper part of the whole of this apparatus, where, at H, there is another short tube curved towards the ground. Water from a reservoir is made to run through the perpendicular tube to the lower part of the condensing apparatus, and fills all the space between the cylinders. When the operation is going on, as the vapours are condensed they raise the temperature of the water, which becoming more rarefied and lighter, flows out of the curved tube.

The condensing apparatus terminates in a brick canal, I, covered and buried in the earth. At the end of this canal is a bent tube, K, which carries the liquid products into the first cistern; when it is full it discharges itself by means of a syphon into a large reservoir; the tube which terminates the canal plunges into the liquid, and thus cuts off the communication with the interior of the apparatus. The gas which is disengaged is conveyed by means of the tube, I L, from one of the sides of the canal, I, above the ash-hole of the surface. This tube has a stop-cock, M, before reaching the furnace, in order to regulate the quantity of gas and cut off the communication at pleasure. That part of the tube which ends at the furnace rises perpendicularly some inches, and terminates, as seen, at N; by this means the gas may be distributed equally under the vase without any risk of the tube being obstructed by either the combustible or the cinders.

Towards the end of the operation the heat is increased so as to make the iron pot red hot; and the time when the operation is completed is ascertained by the colour of the gas flame. At first it is of

a reddish yellow, then it becomes blue, and finally it is quite white, which is a mark that the combustion is carried far enough; or a few drops of water are let fall on that part of the tube close to the furnace which is not surrounded by water, and when it evaporates without noise the calcination is thought to be sufficient. The adapting tube is then separated, and the end of the condensing cylinder is closely stopped by iron plates and brick earth. The lid of the furnace is then lifted off, and afterwards the pot is taken out and immediately replaced by another which has in the meantime been prepared. When the pot which has been taken out is cold, the wood is removed. The acid is then purified; but we shall not at present describe this part of the process, preferring to take from an English work a short account of the various uses of pyrolignous acid. It is sufficient to plunge meat for a few moments into this acid, slightly empyreumatic, to preserve it as long as you please. It not only stops putrefaction, but restores the substance in which this decomposition has begun to a sound state. This effect has in part been ascribed to the empyreumatic oil, and hence the beneficial effects of smoke in preserving meats and fish. By pouring this acid over anatomical preparations, Dr. Jorge, of Leipsic, lately restored some of them from a state of beginning putrefaction. Pieces of meat smeared with empyreumatic oil or tar, although far advanced in a state of putrefaction, and although the weather was warm, were restored to a dry and sound state. If fish be simply dipped in re-distilled pyrolignous acid, and afterwards dried in the shade, they preserve perfectly well, and on boiling them they have not such a taste of empyreumatic oil as to be disagreeable. Haddocks have been salted for six hours, then dipped in pyrolignous acid, and hung up in the shade for six days, and on being dressed were found of a very fine flavour. Beef treated in the same way had the taste of Hamburgh beef and kept as well. Meat to which this acid was applied, with a sponge or wet cloth, kept several days longer in summer than it otherwise would. When the acid has become impure by frequent use, it may be clarified by beating up a dozen eggs with 20 gallons, and heating the mixture in an iron boiler. Before boiling, the eggs coagulate and bring the impurities to the surface, when they are carefully skimmed off. The acid acts on iron, and must therefore be immediately removed from the boiler. Besides these antiseptic qualities of the pyrolignous acid, it has long been used by the calico-printers, though under its more correct name of vinegar.

GAIN OF POWER BY MACHINERY.

It was estimated about six years ago, by three of the most eminent cotton-spinners in Great Britain, that the quantity of cotton thread produced on an average by each spinner, compared with that which one person could have spun on a single wheel, as was the practice before the inventions of Arkwright and others, was as 120 to 1. By improvements since made, this has probably increased to 150 to 1; but taking only the smaller estimate, one person can now produce as much as 120 could have produced prior to these inventions. At present, 280,000 persons are engaged in this country spinning cotton thread, and multiplied by 120, this gives 33,600,000 as the number of spinners who would have been required under the old system to produce as much cotton thread as is now spun in Great Britain.

There is one steam engine at present in Cornwall of 260 horse power, which works day and night; each horse power is estimated as equal to the unassisted labour of six men; and as it would require three sets of men, each set working eight hours, to labour as constantly as this engine, it follows that it does as much work as 4690 persons.

GELATINE.

To the Editor of the Chemist.

Woolwich, June 23.

SIR,—In addition to what has already been published by you in No. XV. of The Chemist, respecting gelatine, it may, perhaps, be of service to mention the relative quantity of gelatine obtainable from the bones of different animals, &c. as well as their other constituents. These will be best detailed by the following table:—

Names of the several Substances employed.	Proportions of Gelatine.	Proportions of Phosphate of Lime.	Carbonate of Lim.	Loss.
Human bones taken from a burying-ground..	16·	67·	1· 5	15· 5
dried, but never interred	23·	63·	2·	2·
Bones of the ox	3·	93·	2·	2·
calf...........................	25·	54·	—	21·
horse	9·	67·5	1·25	22·25
sheep..........................	16·	70·	0· 5	13· 5
elk	1·5	90·	1·	7· 5
hog............................	17·	52·	1·	30·
hare	9·	85·	1·	5·
chicken........................	6·	72·	1· 5	20· 5
pike	12·	64·	1·	23·
carp	6·	45·	0· 5	48· 5
viper..........................	21·5	60·5	0· 5	17· 5
lobster	18·	14·	40·	28·
Teeth of the horse	12·	85·5	0·25	2·25
elephant	24·	64·	0· 1	11·15
Stags' horns..............................	27·	57·5	1·	14· 5
Egg-shell	3·	2·	72·	23·
Mother of pearl	2·5	0·	66·	31· 5
Crabs' eyes	2·	12·	60·	26·
Shell of the cuttle-fish	8·	0·	68·	24·
White coral	1·5	0·	50·	48· 5
Red do	0·5	0·	53· 5	46·

The foregoing results I have taken from the *Annales de Chimie*, tom. xxxiv. p. 68, as obtained by Merat Guillot. By giving them insertion in The Chemist, you will much oblige, Sir,

Your obedient humble servant,

JAMES MARSH.

PREPARATION AND QUALITIES OF SILICON AND ZIRCONIUM.

(*By M. Berzelius.*)

M. BERZELIUS, the Swedish chemist, and one of the most scientific and celebrated men of the day, has described, in a letter to M. Dulong, an extract of which has been published in the *Annales de Chimie et de Physique* for May, a mode of preparing silicon, with its qualities. Of this extract the following is an abridgment:—"Fluoric acid is one of the most convenient agents for the analysis of organic products; and it dissolves things which the other acids will not touch. It has supplied me with the means of determining with more accuracy the weight of the atoms of several substances, concerning which I entertained some doubts. To extract the alkali of minerals, it was sufficient to expose them to the action of fluoric acid, or to the action of a mixture of the fluate of lime and of sulphuric acid. In attempting to reduce fluoric acid by potassium, I succeeded in reducing silica, zirconia, and some other earths, but I was able to obtain only silicon and zirconium in a separate state; the others decompose water with great energy. Pure silicon is incombustible even in oxygen gas. Neither water, nitric acid, caustic potash, nor *aqua-regia* have the least effect upon it;

but fluoric acid, particularly if a little nitric acid is added, speedily dissolves it. Silicum does not decompose nitre, unless exposed to an intense heat; but it detonates with carbonate of potash at a red heat. When silicum is heated with saltpetre, and a piece of dry carbonate of soda is plunged in the mixture, a detonation immediately takes place. By passing the vapour of sulphur over red hot silicum, the metal becomes quickly incandescent. When the combination is complete, which rarely happens, the resulting substance is of a white earthy appearance, and decomposes water with extreme rapidity. Water dissolves the silica, and sulphuretted hydrogen gas is cooled. By this means, a solution of silica may be obtained so highly concentrated, that during the evaporation it coagulates, and deposits portions of this earth in the form of transparent masses, like gum. When *silicuret* of potassium is heated with sulphur, it burns rapidly, and leaves, when dissolved, the silicon in a state of purity. In chlorine, silicum takes fire at a red heat; a liquid, colourless, or slightly tinged with yellow, results, extremely volatile, having the odour of cyanogen, and which, with water, deposits silica in the form of jelly. It is very easy to produce silicum. The fluates of silica and of potash or soda, heated to redness, to dissipate the water, is introduced into a glass tube, closed at one end. Small pieces of potassium are then put in, which are mixed with the powder, by heating them till the metal melts, and by lightly striking the tube. Apply the heat of a lamp, and before a red heat is obtained, a detonation takes place, and silicon is reduced. It is allowed to cool, and then washed with water as long as any thing is dissolved. At first hydrogen gas is set at liberty, because *silicuret* of potassium is obtained, which cannot exist in water. The substance washed is a *hydroguret* of silicum, which burns with rapidity in oxygen gas at a red heat, though the silicum is not completely oxidated. It is then slowly heated in a covered platinum crucible, till it is made red hot; the hydrogen combines with the oxygen, and the silicum will no longer burn in oxygen, while chlorine attacks it rapidly. The small quantity of silica produced may be dissolved by fluoric acid. If the silicum has not been strongly heated, as the acid dissolves it, a slow disengagement of hydrogen gas takes place. According to my experiments, silica must contain 0.52 of its weight of oxygen. Zirconium is obtained in the same manner. It is black as charcoal, is not oxidated either by water or muriatic acid, but *aqua regia* and fluoric acid dissolve it, and with the last, hydrogen gas is disengaged. It burns at a low temperature with great intensity. It combines with sulphur, forming a brown chesnut coloured substance, insoluble in muriatic acid and in alkalies, but which burns with splendour, forming sulphurous acid and zirconia."

QUERIES.

Mr. Editor,—If the following be suitable for your pages, I shall be obliged by their speedy insertion. 1st. What is the best method of obtaining sulphur from native sulphuret of iron, upon a large scale, so that sulphuric acid may be obtained from the disengaged sulphur, and sulphate of iron from the residue?

2d. What is the best method to obtain carbonate of ammonia from the ammonia disengaged during the manufacture of coal gas?

In reading your Analysis of Scientific Journals for May, I perceive you have made some observations on an article in the Annals: "Remarks on Solar Light and Heat, by Baden Powell, M. A." With the import of those remarks I cordially agree; but as the subject is of great importance, being connected with most of the phenomena of nature, and is capable of receiving further elucidation from the luminous rays which are every where emanating from the orb of reason, I request you will not dis-

miss the subject from the pages of the Chemist without some further remarks: and as none of the prevailing theories that I am acquainted with on this subject are satisfactory, or reconcilable with the laws of nature, I propose for your solution, or that of any of your correspondents, the following questions:—Is the sun the primary or secondary source of light; or, in other words, is light emitted or reflected from the sun?—Does heat proceed from the same source, and in the same manner?

Is solar light different in its nature from the light emitted during combustion, animal decomposition, electricity, percussion, and friction? An answer to all or any of the above questions, with any further remarks upon the same subject, will greatly oblige,

Your humble servant
and well wisher,
JUVENIS.

Elland, Yorkshire, June 20.

P. S. Since writing the above, a friend of mine, a reader of the Chemist, has requested me to insert the following, hoping you will favour them with a place in your pages.

What are the changes that take place in a woad vat, by which the deoxidation of the indigo is effected, and what are the new compounds which are formed?

Whence is it that fine wool, Spanish and Saxony, for instance, should take more indigo than the wool grown either in the north or south of England, to dye it the same shade?

A DYER.

I shall be very glad to see in the Chemist, as soon as convenient, an article on distillation, giving a description of the most approved stills and lutes.*

What method is best adapted to obtain acetate of tin, upon an extensive scale and at a cheap rate?

JUVENIS.

* Perhaps our Correspondent A. D., of the distillery at Wandsworth, would favour us with some information on this subject. We are slow to engage in it ourselves, because we know that a neighbouring nation has recently made some discoveries with which we are not acquainted.—ED.

MR. EDITOR,—I understand that at present there is among fashionable people a great rage for bright bay horses, and that horses of this colour fetch a much higher price than of any other. Jockies, Sir, are knowing kiddies; and it is said, that some of them have found out a means of colouring horses of a most beautiful bright bay. I have frequently read of washes to make ladies' hair of different colours; and have heard even of a learned professor in a celebrated university of the north, having carried this art so far, that he appears before his admiring pupils with his hair stained of a different colour almost every day. To such perfection has he attained, that there is no colour, it is said, from the bright sandy locks of his own country-women to the blackest shade of the African wool, including all the varieties of purples and pinks which he cannot imitate. I beg, Sir, through the medium of your entertaining miscellany, to inquire of your numerous readers, the best means of colouring hair, whether of horses, of women, or of professors; and at the same time, I should wish to learn the best means of ascertaining whether the colour of their hair is the work of art or of nature. One would not wish, Sir, to be taken in, either by the cupidity of jockies, the *petit maitreism* of professors, or the coquetry of ladies.

I am, Sir,
Your obedient servant,
PRISM.

TO PRESERVE GRAIN.

THE reason why a people who live chiefly on potatoes are subject, like the Irish, to severe vicissitudes of famine, and of momentary plenty, is, that the crop will scarcely keep from harvest to harvest, and there is no means of preserving it, so as to make the exuberance of one

season compensate the deficiency of another. In this point of view, wheat and grains of all kinds, which can be kept for two or three years, are much the most valuable articles of food. Whatever serves, therefore, to preserve grain in a state of perfection, tends to equalize the quantity of food which can be obtained every year, and thus to relieve society from the alternate vicissitudes, which the seasons bring, of dearth and plenty. There are also, probably, few of our readers who have not seen those immense granaries on the borders of the Thames, in which, when grain is stored up, it has to be frequently moved and turned, at a considerable expense, to preserve it. Under these points of view, it appears of some importance to know how to preserve grain in the greatest perfection, and at the least expense. In many parts of the Continent, this is done by depositing it in holes constructed in the earth for this purpose; and this has always been done on the idea that if air and moisture could be completely excluded, the grain might be preserved for any length of time. It has, in fact, long been known that grain or flour so stowed in casks as to be perfectly air-tight, has been preserved for years unaltered. Under the influence of this same idea, in 1819, the Count Dejean, according to the *Annales de Chimie*, caused some casks to be made, which were covered with lead, and into which grain of different kinds, properly dried, was put, and then the casks were hermetically sealed. They were opened at the end of three years, and the grain found to be in a perfect state of preservation. As grain in this state sustains no loss, and requires no attention, it is supposed that the expense of the casks and of the lead will not be equal to the cost of preserving grain not so guarded. There can be no doubt of the accuracy of the principle on which this process proceeds; and as little doubt, we believe, that in this country it might be brought into practice by some still cheaper method than that recommended by Count Dejean.

EXTRAORDINARY FALL OF THE BAROMETER.

The journals of Germany remark an extraordinary fall of the barometer on January 23d, 1824. On that day it stood at 26° 11′ at Leipsic, it having been (says the Journalist) only three times as low, namely, in 1799, 1782, and 1783, during the whole of the eighteenth century. On referring to the meteorological journals kept in England and France, we observe, that in both these countries also the barometer stood very low on the same day. By the meteorological diary given in the Quarterly Journal of Science, it appears to have been at 28° 70′; and by the meteorological observations in the *Annales de Physique et Chimie*, it stood at 730° 71′, being in both cases considerably the lowest of the month, and much below the average of the year. At Paris and Leipsic the wind was S.W.; at Althorpe, in Northamptonshire, W.S.W. and N.W.; and it rained somewhat both at Paris and Leipsic.

POISON OF THE UPAS TREE.

The poison of the upas tree has lately been subjected to analysis by Messrs. Pelletier and Caventou. It appears there are two species of the upas poison; one is the produce of a plant, called by M. Leschenaut, *strychnos ticute;* the other, the terrible upas tree, is called the *anthiaris toxicaria.* These chemists have made experiments on both poisons, and state the following facts as the result:—The poisonous principle of the *strychnos ticute* is that alkali which has before been detected in the *strychnos nux vomica*, and to which these chemists give the name of *strychnia.* From the upas they obtained it very pure; and half a grain of it, diluted with water, injected into the *pleura* of a rabbit, destroyed the animal at the end of fifteen seconds, by one terrible attack of *tetanos.* A quarter of a grain dissolved in diluted acetic acid, given to another rab-

bit, produced a still more terrible and speedy dissolution. The poisonous principle of the other upas tree, or *anthiaris toxicaria*, is a bitter substance, soluble in water and alcohol. This bitter substance is composed of a colouring matter, of an acid, and a particular substance, which seems to be the active part of the poison, and which these chemists suppose to be a vegetable alkali. This vegetable alkali has the same effect on the animal economy as the poison of the upas tree, but is much more energetic. It differs somewhat in its action from *strychnia*, the former producing convulsions, with relaxation, and not being so speedy in its destroying effects as the latter, which seems suddenly to arrest with a single convulsion the whole functions of life.

THE BARK TREE.

The following is an extract from a Report lately made by the celebrated traveller, Baron Humboldt, to the Academy of Sciences at Paris, on a work of Mr. Auguste St. Hilaire, who returned to France not long ago, from the Brazils, bringing with him 7000 plants, 2000 birds, 16,000 insects, and 130 mammiferous animals. "The discovery," says the Baron, "of the true *cinchona* in the eastern part of South America, far from the Cordilleras, must strike those who attend to the distribution of vegetables over the surface of the globe, and the geological causes which have influenced it. At present not a single species of *cinchona* is known to exist, not even the *exostema*, either in the mountains of *Silla de Caraccas*, where the *befaria*, the *aralia*, and the *thibaudia*, and other mountain plants of New Grenada grow, or in the wooded mountains of Caripe or of French Guiana. This total want of the *cinchona* and *exostema* genders on the table land of Mexico, and on the eastern parts of South America, north of the equator, is more surprising, because the Antiles are not destitute of species of *bark* trees. The *quinina* of the Cordilleras does not extend further east in the northern hemisphere than the 72 degree of longitude west from Paris, or the mountains of *Micachista* of the *Sierra Nevada* of Merida. The *cinchona ferruginea*, C. Vellozii, and C. Remijiano of Mr. St. Hilaire grow on the table lands of the province of Minas-Geraes, at the height of 100 *metres*, in a temperate climate between 22° and 18° of southern latitude. They are regarded as certainly indicating the presence of minerals containing iron wherever they grow. The bitter and astringent bark of those *quinina* (Quina da Serra) of the mountains of Brazil resembles very much in its flavour the *quinina* of Peru and of New Grenada. Their febrifuge qualities are not, however, so strongly marked as those of a still more celebrated tree, the *strychnos pseudoquina*, which is found in the diamond districts, in the deserts of Goyaz, and in the western part of Minas-Geraes. Of all the medicinal plants of these vast countries, the *Quina do Campo*, or *strychnos pseudoquina*, is most in use, and best known. The physicians of Brazil give the bark in powder and in decoction; and it is a beneficent gift of nature to a region where intermittent fevers are unfortunately too frequent. The virtues of the *strychnos pseudoquina*, as a febrifuge, are found not to be inferior to the best species of the *cinchona* of the Cordilleras; and though the former has not at Brazil entirely superseded the use of imported bark, it may one day be exported to Europe in great quantities.

M. Vauquelin has analyzed the strychnos, and found in it a peculiar acid, but neither *brucia quinina*, nor any of the poisonous principle found in the *strychnos nux vomica*. It was before known that *strychnos potatorum* was destitute of this deleterious principle, and that the pulp of the fruit of the nux vomica might be eaten without any danger. The various parts of a plant do not all contain the same principles, and if in the same family of plants, in the same gender, and in plants of an analogous structure, we do not find very striking chemical differences, it must be recollected that

such anomalies are more apparent than real; for, according to the experiments of M. M. Gay Lussac and Thenard, on vegetable chemistry, the same elements, with very small variations of proportion, are differently grouped, and produced different combinations, the effects of which on the nervous system may be diametrically opposite.

BATTLES AND LOVES OF LEECHES.

Mankind are more indebted to the labours of the husbandman than they in general confess; for not only their comforts but their morality depends on his exertions. It is found by experience, that humanity and hunger cannot exist together; and in spite of the tirades of ascetic philosophers against enjoyment, it is clear that full bellies are the great source of peace and love and good-will amongst men. it is quite a mistake to suppose that Cannibals eat their brother men out of pure love to human flesh, and a natural delight in cruelty. They only do it as the half-starved sow is known to feed on her young—out of hunger; and wherever they can find somewhat to satisfy this craving, though it be by toils and dangers, amidst quaking ice-bergs, like those of the Esquimaux, and though their food be only whale blubber, they prefer this to steeping their hands in human blood. The effect of full bellies in promoting harmony and tranquillity is wonderfully apparent at present in this country. We now and then feel a little puff of religious discord, but the fierce spirit of sectarianism is gone to sleep in the lap of animal indulgence. Radicalism and terrorism have both been choked by cheap bread; and it is plain, if there were plenty of potatoes and rags in Ireland, we should hear nothing of either Orange or Catholic Associations, White-boyism, Blue-boyism, and the other *isms* and schisms of that unhappy land. All have their origin in the people having incautiously multiplied faster than the murphies; and the emptiness of their stomachs is the cause of the discontent in their hearts. It is well known that the same law applies to animals as well as men; and dog will only eat dog when he is on the point of starving. A French author, M. Noble, has lately shown that the same fact is true of leeches. As long as these little water serpents can find the blood of man or beast to suck, they live in great harmony with one another, go on depositing their eggs, and propagating their kind, nine, ten, eleven, and even as many as fourteen in a family.—When, however, they have exhausted their stock, like the Irish, they turn on one another, and, like cannibals, feed on their own dead.

"Among the causes (says this physician) which augment very much the mortality of leeches, must be placed those battles (of course they are naval battles, though the physician has not described their Nelson or their Van Tromp,) which they fight when they are *too numerous* in the same vessel, or when their *food is not sufficient;* the weakest fall, and the *others feed on them.* To obviate this inconvenience, it was found only necessary to place them in a large reservoir, supplied with a stream of fresh water.—When the winter came, like Laplanders, they buried themselves in the mud; and when the returning warmth of spring brought them forth, they were attended with a great number of young ones. Holes were found in the sides of the reservoir, and in each of these there was deposited a cocoon of an oval form, and as large as the cocoons of the silkworms. They were of the texture outside, and had the appearance of very fine sponge. Several of them were opened; some were found empty, and their interior was compact and polished, as if covered with a coat of varnish; others were filled with a transparent and homogeneous jelly. In the most advanced, nine, ten, and even fourteen young leeches were found."—*Bulletin des Sciences Technologiques.*

To Correspondents in our next.

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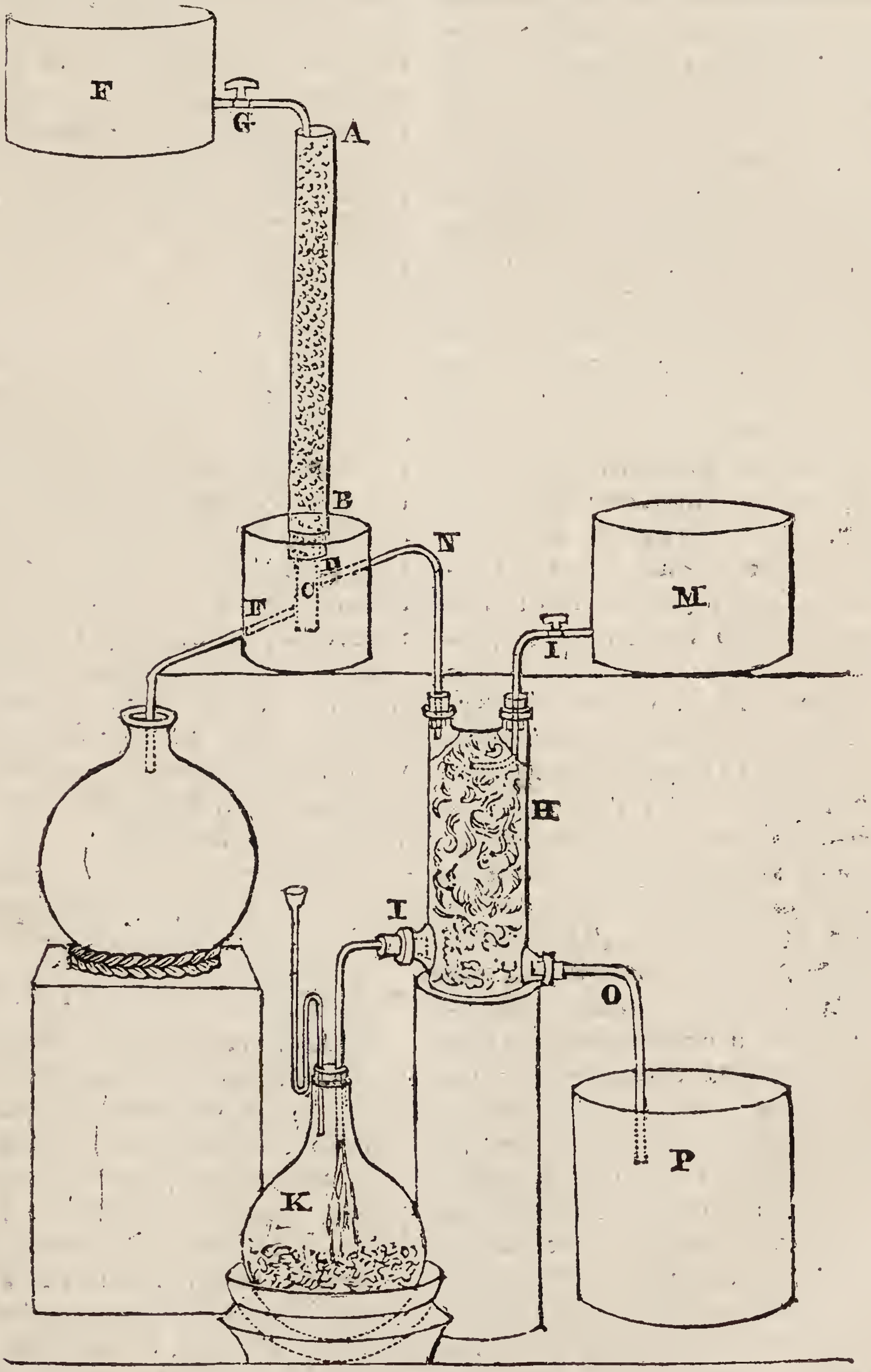
The Chemist.

"——Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. XVIII.] SATURDAY, JULY 10, 1824. [Price 3*d*.



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THE ABSORBING AND PRODUCTIVE CASCADE.

Description of the Plate.

THIS is an apparatus invented and employed by Mr. Clement, a celebrated French chemist of the present day, to promote the absorption or solution of gases. It is known that this takes place in proportion to the pressure on the absorbing liquid, the extent of surface exposed to the absorbing action, and to the length of time in which it is exposed. If the pressure, however, is very great, the vessels are apt to burst, and therefore, in general, the object chemists have had in view has been to strengthen the influence of the two other principles we have just mentioned. Mr. Clement employs the following means:—A B is a long cylinder full of a great number of small glass or porcelain balls, about one-third of an inch in diameter. This cylinder is fixed in another of a much greater diameter, in which a hole, C, is made corresponding to the lower extremity of A B, and with which two small tubes, D E, communicate, one being intended to introduce the gas, the other to empty the liquid. From a reservoir, F, a stream of water flows by means of the tube, G, which is supplied with a stop-cock, so that this stream may be regulated at pleasure. The water in its descent is detained by all the little balls, which it wets successively, and is a considerable time before it reaches the bottom; on the other hand, as the gas arises it occupies all the empty space, is much divided and subdivided, and, as it also is detained in its progress upwards, the time it is in contact with the water is very considerable. The author of this invention supposes, that it is more than three hundred times more efficacious in promoting the absorption of a gas than the ordinary apparatus. This he calls the absorbing cascade, and to it he adapts another apparatus, which he calls the productive cascade. It is intended to produce gas for a considerable period of time, and in a more convenient and less expensive manner than by the ordinary methods. Thus for example: to prepare chlorine, a large vessel, H, provided with four mouths or holes, is filled with the oxide of manganese broken into large pieces; the mouth, I, is connected with a leaden vessel, K, containing common salt and sulphuric acid. By the tube, L, a small stream is made to flow from the reservoir, M, which gradually moistens the whole surface of the pieces of manganese, and permits the muriatic acid gas to attack and dissolve it very easily. The chlorine which is produced passes by the tube, N, into the absorbing cascade, while the muriate of manganese is carried off as it forms by the water through the tube, O, into the reservoir, P. By using this apparatus there is no occasion to reduce the manganese to powder, and a much larger quantity may be operated on at the same time, without the operator being under the necessity of frequently renewing the charge of materials and dismounting his apparatus. We should suppose that many of our readers who have chemical operations to perform, will find Mr. Clement's a very useful method.

ANALYSIS OF SCIENTIFIC JOURNALS.

ANNALS OF PHILOSOPHY FOR JULY.

GREAT complaints have lately been made of the inefficiency and barrenness of scientific journals; and on this subject a literary periodical thus expresses its opinion: "The existing scientific journals have, it strikes us, many grievous defects; first, men of acknowledged scientific talent rarely contribute to them, or at least do not put forth their strength in the contributions they transmit. Such persons are no doubt unwilling to have the fruits of their most profound researches presented to the world mixed up with such a mass of crude and frivolous speculation as we generally find in these jour-

nals. Secondly, we think the editors mistake their proper vocation. Their leading object ought to be to give us clear and popular accounts of the discoveries made at home and abroad, showing, to the unlearned as well as the learned, the effect, application, and true value of each new truth added to art or science. Instead of this, we have the original speculations (often the mere sweepings of the study) of fourth and fifth-rate men, upon subjects of ninth and tenth-rate importance, repulsively abstruse, and forbiddingly technical; and, along with these, whole pages, rough and round, from "the excellent work" of A., or B., or C., already in every body's hands, and given without note or comment. The editors ought to know that half a sheet upon a subject easily intelligible, and bearing on the business of life, such as steam navigation or gas light, is worth a volume upon the anatomy of gnats' legs, or the double refraction of a wren's eye. What is merely curious should not be excluded, but kept in its proper place. Nor is a good idea the worse for being new; but still it is better to be useful and popular, than to be original and trashy. Philosophical journals ought to be addressed not exclusively to men of profound science, who are few in number, and will not be satisfied with the scraps they get in such works, but to the mass of persons whom business or curiosity interest in scientific pursuits, without having taste or time for deep researches. Such journals should be considered as the links that connect the learned with the industrious—the strainers and digesters through which the truths of philosophy must pass to fit them for assimilating with the system of active and busy life. The success of the Mechanics' Magazine, the Chemist, and other periodicals of that description, shows how ample the field of usefulness is in this department, if our journalists of a higher class would get into the right track."—*Scotsman.*

As the present Number of the Annals bears the name of Mr. Children, as an additional editor, we presume that it has been placed under a new administration, and that it has been found necessary to put forth greater vigour, or quit the field. If the editors of the Mechanics' Magazine and the Chemist, have no other gratification, they at least know that their exertions have compelled other editors to set about improvement. The scientific literature of the country will be henceforth much better, and for this beneficial change the world will be greatly indebted to exertions, which (we will not stoop to the common-place cant of zeal for the public) were made for our own benefit. We cannot, however, yet compliment the editors of the Annals, much as we may be disposed to imitate the parliamentary vice of sacrificing a principle to a flattering phrase, with having made any conspicuous improvement in the matter of their journal. There is much the same quantity of what is merely curious, and nearly the same deficiency of what is really useful. We first meet with—

A BIOGRAPHICAL ACCOUNT OF ASSESSOR JOHN GOTTLIEB GAHN.

Why Mr. Children, who we conjecture is the author of this paper, chooses to prefix Mr. Gahn's title, which is unusual in England, though very common in Germany and Sweden, we are at a loss to discover. What should we think of "Biographical Memoirs of President of the Royal Society Davy," or "Excise Collector Wordsworth?" and if these modes of expression are strange, why, we ask, does Mr. Children introduce a similar mode, because the man was a foreigner, and had his title prefixed to his name in his own country? But, not to be hypercritical, we shall take from the paper an outline of Gahn's life.

J. G. Gahn was one of the most distinguished chemists of the last fifty years. He was born on Aug. 17th, 1745, at Woxna iron works, in South Helsingland, and was the son of Hanns Jacob Gahn, trea-

surer to the government of Stora Kopporberg. He went to school at Westeras, and was afterwards sent to the University of Upsala. His mind was early turned to scientific pursuits, with a zeal which at once carried him rapidly forward, and made him study deeply as he went. While yet in the academy, he dropped a specimen of crystallized carbonate of lime, and the fall shattered it into fragments. By this accident the original nucleus of the crystal was developed, and Gahn, pursuing the idea which this suggested, and which would have been lost for any other person, succeeded, by cleavage, in extracting the rhomboid, which constitutes the primitive form of this mineral, from a great variety of secondary crystals. Bergman, to whom this observation and discovery were communicated, published, immediately afterwards, a dissertation on the forms of crystals, which called forth the well-merited admiration of men of science. But while Bergman, says this author, reaped this honour from his essay, he had omitted to mention that it was the discovery of the pupil which had furnished the basis of all the reasonings of the master. Bergman was distinguished for his candour; he was as much beloved as admired; and we are rather slow to believe this questionable story of his observations having been founded on the discovery of another, which he took care not to acknowledge. Gahn afterwards succeeded in analyzing the earth of bones, and in showing that it was phosphate of lime. The same substance, when occurring in the mineral kingdom, has since baulked the efforts of analysts of considerable celebrity, and Gahn's success, therefore, reflects honour on his sagacity. The merit of this discovery was attributed to Scheele, as it was first announced to the public in his works, without the name of Gahn being mentioned. The next thing in which he succeeded was to reduce manganese to a metallic state; and though he is not now deprived of the honour of having discovered this process, it was at first made known to the world by the works of Bergman. He next taught philosophers the scientific value of the blow-pipe, which, before his time, was only used by workmen, and drew up a concise summary of directions for its use, which were published in Berzelius's Elements of Chemistry. He was also the inventor of a balance, remarkable both for its extreme delicacy and the simplicity of the plan on which it is constructed, so that it can be made by any ordinary workman. In all these cases Gahn seems to have been so indifferent to celebrity, as to have made no effort to claim what was fairly his due. The author of the biographical memoir which we are now abridging, ascribes his unwillingness to come before the public, to a want of confidence in the value and completeness of his discoveries. He chose to revolve them again and again in his mind, and wished to submit them, according to the poets' rule, to the test of a nine years' examination. Though this may probably have partly been his motive, we are willing to attribute his conduct to another cause. Those only, we believe, are tenacious of celebrity who are destitute of that more solid enjoyment which results from an active prosecution of the business of life, and from energetically fulfilling the duties of a man and a citizen. Gahn was not a mere philosopher, deriving not only celebrity, but perhaps even his office, from his discoveries; he was the active manager and conductor of several manufactories, and held a distinguished office in the political department of a free state. It was probably from obtaining both advantage and honour from these two situations, that he was careless about that scientific celebrity, to procure which is the object of so many intrigues, and so much writing by men who are nothing but philosophers.

Gahn's father died when he was young, and left him in narrow cir-

cumstances, which compelled him to exert himself; and as he was destined to an employment about the mines, he took up his abode with the miners, and studied their practices till he had completely made himself master of all their knowledge. Having, in 1770, made his acquirements known, by an academic thesis on the improvement of iron foundries, he was soon afterwards appointed, by the College of Mines, to make experiments as to the melting of copper, at Fahlun. In consequence of his experiments, and by his recommendation, a new method of proceeding was immediately adopted, which saved a great deal of expense, and is followed to this day. He then acquired a part of the extensive works at Stora Kopporberg, where he settled as superintendent, and soon had an opportunity of obtaining wealth and adding to his reputation. During the American war, a sudden and a great demand was made for copper, and a very large order was sent to Fahlun, which Gahn, at his own risk, though others conceived it chimerical, undertook to complete. He succeeded, and not only added to his own wealth, but gained the increased confidence of all with whom he was connected. From the time of his first settling at Fahlun, in 1770, till 1785, Gahn took a deep interest in the improvement of all the chemical works of that neighbourhood; and, in conjunction with others, he established manufactories of sulphur, sulphuric acid, and red ochre, which were a source of great emolument to the proprietors. In 1780, the College of Mines, as a testimony of their sense of his exertions, bestowed on him a gold medal. In 1782, he received a royal patent as mining master; in 1784 he was elected a member of the Royal Academy of Sciences, at Stockholm; and in the same year he was appointed Assessor in tho Royal College of Mines. About the same period also he married Anna Maria Bergstrom, with whom he lived happily thirty-one years, and by whom he had one son and two daughters. In 1773, he had been elected a chemical stipendiary to the Royal College of Mines; and from that time till 1814 every chemical problem the College had to decide was referred to him. In 1803 and 1804 a case occurred which evinced his skill. In consequence of the copper sheathing of a vessel having been corroded to a great extent, there arose a prejudice against the Fahlun copper, and Gahn was appointed to ascertain if there were any grounds for this prejudice. He demonstrated that the copper contained no pernicious ingredients, and it afterwards turned out that the copper of this vessel had not been obtained at Fahlun.

In 1778, Gahn began his political career, being in that year returned by the Mining Directory of Fahlun to the representative body of burghers. In the momentous discussions which took place in the Swedish Diet, in 1778, 1809, and 1810, Gahn took an active part, and was always a member of the constitutional committee. In 1795, he was chosen a member of the committee for directing the general affairs of the kingdom. In 1810 and in 1812, he took an active part in the measures adopted for the maintenance of the poor, and for the promotion of agriculture.—When it is considered that the mining district of Sweden which Gahn represented has long been distinguished for cherishing a love of freedom, that it has possessed numerous valuable privileges unchanged for ages, it is eulogium enough for Gahn to say, that his brother miners found in him a worthy representative, and a man adequate to the great trust reposed in him. It must be remembered that the period when he held this trust was one of peculiar delicacy and difficulty,—one when all the thrones of Europe were convulsed; and even Sweden felt the influence of that moral tempest which began at Paris. In this period of difficulty, Gahn acquitted himself with honour; and he is at this day as much endeared to his countrymen by the ardour and disinterestedness with which he defended their public

rights as by his scientific improvements. Gahn, therefore, was a patriotic citizen, as well as a good man and a great chemical philosopher; and enjoying the high honour acquired by the first of these characters, might well be careless of that scientific celebrity which it is the great object of all those who wonder at his carelessness to acquire. The end of Gahn was quiet and serene. His wife died about 1815, and from that time to 1818, his health, which had never been robust, visibly declined. In that year his decay was more rapid; he became weaker and weaker, and on the 8th of December, a calm and peaceful death terminated his well-spent, and, we doubt not, happy life.

Such, we believe, is ever the end of such men; and those who delight, as we confess we do, to trace the beneficence of Nature, may read this character even in the manner by which *she* removes man from the scene of his enjoyments. She gradually blunts his perceptions, both of pleasure and of pain; she takes away one tie after another, loosening all his holds of life so gently as to be imperceptible; and then she wraps him in the sleep of death, more quietly than ever baby was rocked to rest by the tenderest mother. This, we say, is her course, as exemplified in the end of men like Watt and Gahn.

> ——— How calm their exit;
> Night dews fall not more gently on the ground,
> Nor weary worn-out winds expire so soft. *Blair.*

—But man, thwarting Nature, plunges into intemperance; he hurries to the field of blood; he lifts the sword of vengeance, and sacrifices the prolonged happiness of life and the balmy quietness of natural death to some erroneous theory of pleasure, some baneful prejudice, which has been palmed on him by ambition, or some absurd notion of crime and its retribution, which leads him madly in the same breath and by the same deed, both to applaud and punish the same crime.

(To be continued.)

DICTIONARY OF CHEMISTRY.

Argentine Flowers of Antimony. An old name for *antimonious acid.*

Argentum Vivum, *quicksilver, mercury.*

Argil, *alumina.*

Argillaceous Earth. Another name for *alumina.*

Argillite, *argillaceous schistus, clay-slate.*

Arnica Montana. The flowers of this plant are employed in medicine.

Aromatics. Plants and other substances are so called when they have a fragrant and pungent taste and smell. Their peculiarities appear to reside in an oil which is distilled off either with water or spirit.

Arrack. A spirituous liquor, manufactured from rice, and chiefly at Goa on the Malabar coast, and at Batavia.

Arragonite. A mineral so called from having been first found in Arragon.

Arseniate of Potash. A species of *carbonate of lime*, the arsenical neutral salts of Macquer.

Arseniates. Salts composed of *arsenic acid* and a base.

Arsenic. A metal of a bluish-white colour. What is called arsenic in commerce is a white oxide of this metal, or *arsenious acid.*

——— Acid. A compound of 100 parts of arsenic and 52.631 of oxygen.

———, Butter of, *chloride of arsenic.*

———, Sulphuret of, *realgar.*

Arsenious Acid. A compound of 100 parts arsenic and 34 parts oxygen; *white* arsenic.

Arsenites. Salts composed of arsenious acid and a base.

Arum Maculatum, *wake robin, cuckoo point.* Formerly used in bleaching.

Asafœtida. A well-known medicine. It is obtained from the root of a large plant which grows in Persia. The root is cut, and the asafœtida issues in the form of a thick juice, like cream, which becomes hard and of a brown colour by exposure to the air. The

stench of this substance is so great, that the Persians are obliged to hire ships expressly for conveying it, as merchants will not take it on board vessels with any other species of cargo.

Asbestos, *asbestus*. A silky-like mineral, of which there are five varieties, thus named—*amianthus*, *common asbestos*, *mountain leather*, *mountain cork* or *elastic asbestos*, and *mountain wood*.

Ashes. In chemistry, as in common life, this term signifies what remains after combustion; but it is sometimes usual in chemistry to understand by it only what remains after vegetables have been burnt.

Asparagin. A peculiar vegetable principle, which forms spontaneously in asparagus juice, when evaporated to the consistence of syrup. It is then in crystals.

Asphaltum, *bitumen judaicum*, *Jews' pitch*. At present *bitumen* is a name applied to a class of bodies, of which *asphaltum* is one. It is found in great abundance on the shores of the Dead Sea, in the island of Trinadad, in Albania, and in numerous other parts of the world. It is found soft on the shores of the Dead Sea; and it is supposed that originally it was all soft, and that it grows hard by exposure to the air. The *asphaltum* of the shops is said to be different from native asphaltum. The Egyptians employed it to embalm human bodies, and in old books it is distinguished by the name of *mumia mineralis*.

Assaying. The art of determining the quantity of precious metals in any mineral or metallic mixture, by analyzing a small portion of it. It is a particular branch of trade, and there is an *Assay Master* to his Majesty's Mint, as well as numerous private assay masters.

TO MAKE ICE IN THE MIDST OF SUMMER.

We showed our readers, in our last Number, a very easy method of producing such a degree of cold as even to freeze mercury; and as that only takes place at a temperature considerably below the point where water freezes, they can, of course, easily freeze water in the midst of summer by the same means. There are, however, several other methods of accomplishing the same effect; and as iced wine, iced fruits, and iced creams are great luxuries in summer, though an ice-house may not be at hand, we shall state some of these methods. Take eleven drachms of muriate of ammonia, ten of nitrate of potash, and sixteen of sulphate of soda. They should be recently crystallized, and contain as much as possible of the water of crystallization without being damp. Reduce each of these salts separately to a fine powder, and then mix them gradually in a vessel made of fine tin plate with five ounces of water; as the salts dissolve a degree of cold will be produced sufficient to bring the thermometer below the freezing point. If a little water in a test tube be immersed in this mixture as the solution is going on, in about ten minutes it will be frozen. The vessel in which the mixture is made should be just large enough to contain it. Any thing, such as wine-bottles, jars containing conserves and fruits, lemonade for sick people, &c. immersed in this mixture, or moistened with it, and exposed to the action of a brisk current of air, may be rendered cold in the hottest day.

QUERIES.

To the Editor of the Chemist.

Sir,—Can you inform me of a method of blueing steel equal to the blades of swords, and also of gilding it after it is blued? This will be of use to me.

I am, Sir,
Yours respectfully,
A. R.

July 1st.

Sir,—An answer to the following queries, through the medium of The Chemist, will greatly oblige,

A Constant Reader.

The best mode (if any) of ex-

tracting and preserving the juice of onions in a concentrated state?

From what kind of fat is the best tallow prepared; and what is the best method of preparing and purifying the same?

Sir,—A few days ago, whilst looking at some castings in an iron founder's yard, my attention was directed to a worn-out pot of considerable thickness. Upon inquiring the purpose to which a casting of such strength and dimensions was applied, I was informed, that it had been a shot manufacturer's melting-pot; and that, notwithstanding its unusual thickness, (two inches in one part) it had not been in use more than *three months.*

It appears, Sir, that these pots, when firmly set in brickwork, are employed in the preparation of an alloy of arsenic and lead, technically called *temper*, which is afterwards manufactured into shot. This composition is exposed to the temperature of ignition to effect a union of the two metals; but such had been the destructive agency of the mixture, aided by the high temperature employed, that the *sides* of the iron pot were completely *cut* through.

Upon inquiry I have learned, that the injury is principally sustained at the *surface edge of the melted alloy*, and as the pot becomes destroyed on the upper circumference, smaller charges are necessarily thrown in until the vessel is incapable of holding a sufficiency of the mixture. Perceiving, Sir, that it is one of the objects of your useful Publication to promote the improvement of the chemical manufactures of the kingdom, you will permit me, in furtherance of that object, to propose the following questions:—Is the injury sustained by the melting-pot occasioned by the alloy acting on the iron, and thus forming a triple compound of arsenic, lead, and iron? Why is the action of the alloy on the vessel confined to the *edge* of the melted compound *only?* Is the injury caused by any peculiarity in the cast iron of which the pot is made?

I have little doubt, Sir, but what satisfactory answers to the above will be given, provided you deem this communication worthy the attention of the Chemist.

I am, Sir,
Respectfully yours,
Arsenicum.

Chester, July 3.

EXTRAORDINARY ENGINE FOR PROPELLING VESSELS.

A Mr. Samuel Brown has just constructed a very curious engine, to be employed as the actuating principle of machinery instead of the steam-engine. It is put into operation by the agency of fire, water and air. It consists of many parts, and is not altogether free from complication; but at present we see nothing in its principles inimical to philosophy, and have no doubt it will act, though as to its power and operating cost, as compared to the steam-engine, we have no very favourable opinion.—*London Journal of Arts and Sciences.*

EXPLOSIVE ENGINE.

An engine of a very remarkable kind is, we understand, about to be brought into public notice, which, if it answer the expectations of its inventor, may ultimately supersede the use of steam-engines. At the lower end of a small cylinder is placed a minute apparatus for oil gas. As the gas is generated it elevates a piston, so as to admit as much atmospheric air as, when combined with the oil gas, will render the mixture explosive. When the piston has reached this height the gas explodes, and the mechanical force of the explosion is employed to drive machinery. Experiments have, we understand, been actually made with this power, which was employed to force up water to a considerable height.—*Edinburgh Journal of Science.*

Does this allude to Mr. Brown's engine?

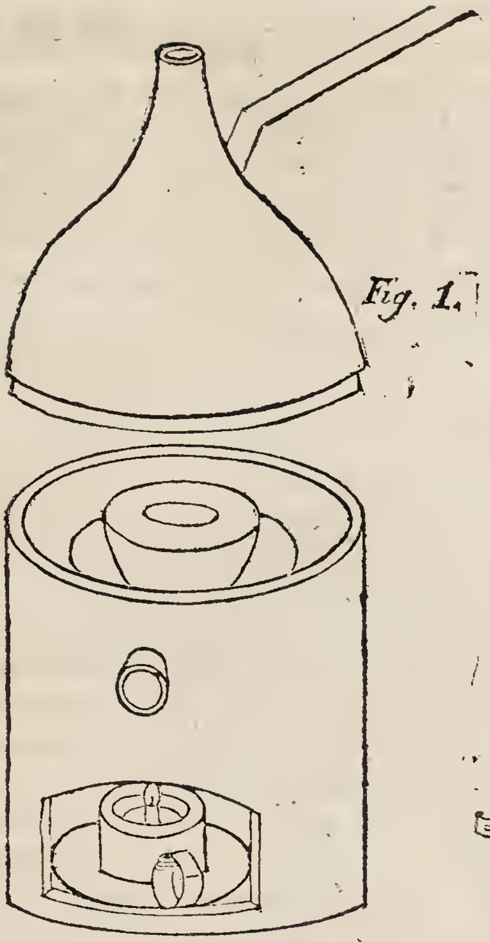
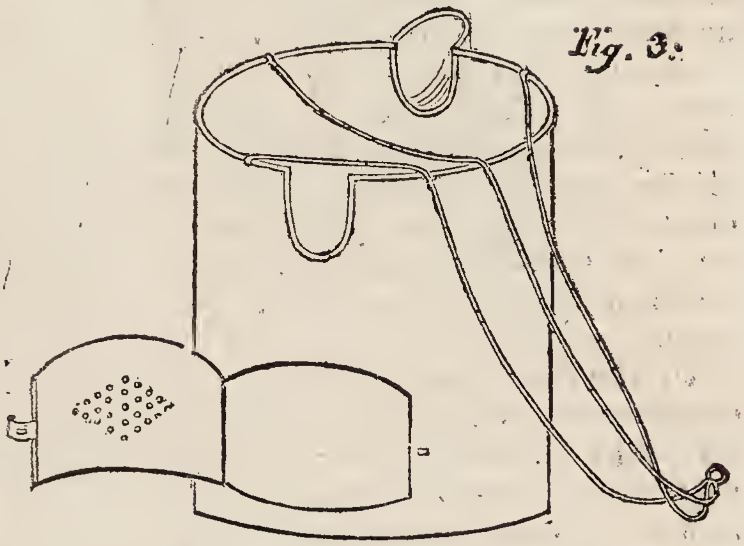


Fig. 1.

Fig. 2.

Fig. 3.



ON PURIFYING THE AIR OF APARTMENTS.

On the Continent, where every thing is regulated by the governments, and where boards of public health and public education watch with a sort of divine prescience over both the bodies and souls of the animated clods which cannot take care of themselves, the subject of this paper is reduced to a regular science or art, and is as regularly treated of in books as mathematics or mineralogy. Our readers need not on this account be under any fear for us, as we hold to the simple rule, that to promote a free circulation of air is the best means of keeping our apartments healthy. At the same time, it does happen, that the windows of a sick chamber cannot be always opened, or the wards of an hospital exposed to a draught, and then a chemical means of purifying the air may be both gratifying to the senses of the patient, and contribute to his recovery. If chemistry had done nothing else for man than explain the manner in which his breathing vitiates the air, and then shewn him how the vitiating substances were to be god rid of, and the air again rendered pure and health-giving, she would have conferred on him an incalculable benefit. But for this discovery, it may be doubted if many of the arts which are now practised, could ever have been carried on, and certainly could only have been so at a great expense of human life, and, what is worse, at a great expense of suffering. To give an example of this, which is perhaps not so well known to our readers:—It had long been observed and regretted, that those who worked at gilding by means of the amalgam of mercury and gold, were subject, from inhaling the vapour of the mercury, to a particular disease, which deprived them of the use of their limbs. Mr. Raviro, a large manufacturer of gilded bronze, living at Paris, who had witnessed through his whole life the sad effects of this on his workmen, bequeathed a sum of 3000 francs as a reward to any person who should find out a means of guaranteeing gilders from the insalubrious effects of the mercurial exhalations. This circumstance directed the attention of M. Darcet, a French chemist of considerable eminence, to the subject, and he succeeded, by promoting a circulation of air through a large funnel

in one direction, to carry off all the vapours, mercurial and others, of the shop, and convey them above the tops of the houses, so that they were rendered perfectly innocuous. He has now shown the success of his plan in more than a dozen workshops, and the Prefect of police at Paris, has, in consequence, given orders to allow of no new gilding establishment unless it is fitted up according to M. Darcet's method. Thus has this gentleman, by attending to the principles of chemistry, been able to protect a large class of workmen from disease, to ensure them a longer period of existence, and to make that period more pleasurable and free from pain.

In the function of respiration, oxygen gas is inhaled, and about an equal quantity of carbonic acid gas exhaled; and a constant renewal of the former gas, that it may be inhaled, and a removal or dispersion of the latter, that it may *not* be inhaled, is necessary for our existence. Independent of this, it has lately been shown, by Dr. Edwards, that azotic gas is also constantly absorbed, and as constantly given out. To provide for this destruction of vital air, a current or draught of fresh air seems the only certain remedy. But independent of this, mephitic gases, as they are called, which exhale from marshes, which are generated in crowded apartments, and supposed to be the active agents in spreading contagious diseases, are known by their effects to be frequently present without that proportion of vital air being diminished which is necessary to existence, or without any chemical test which we know of being capable of detecting them In fact, numerous experiments have been made on the air of hospitals, in which contagious fevers were raging, and on the miasma of marshes, without succeeding in detecting any thing beyond the usual ingredients of atmospherical air. As in general the noxious ingredients arise from exhalations from the body, there is some reason to believe that they are combined with the water of the atmosphere, rather than the air, and that the means taken to dry the air before experimenting on it, have deprived it of its noxious qualities. If we suspend a glass balloon (see the plate) filled with ice, in a room

crowded with people, and where respiration is somewhat impeded, the vapour will speedily condense on the whole of its surface, and may be easily collected in a bottle placed below the balloon; and we are told if this water be corked up and exposed to a temperature of 78° Fahr., it will speedily run into putrefactive fermentation, and the bottle, on being opened, will exhale a very fetid odour. At the same time, if the air which contains this vapour be analyzed, it will be found not deficient a twentieth part of oxygen, and nothing deleterious will be detected in it. Experience has, however, shown, that air loaded with these sort of putrefactive vapours is very noxious, and similar vapours are probably the cause of death by marsh miasma, and of the contagion of fevers. On this supposition, we see the utility of heat, artificial heat, however, which disperses this vapour wherever it is applied in destroying, as it is supposed to do, the cause of contagion.

Under the idea that impure air was air deprived of its relative quantity of oxygen gas, and under the influence of some other theoretical ideas of the causes of air being unhealthy, various methods have been proposed of adding to the purity of the air. It has been found that acetic acid is very beneficial; and as its odour is also very grateful, it is customary to convert it into vapour, under the idea that this destroys contagious air, by plunging a red hot iron into a sufficient quantity. On board our ships of war, where the men are so crowded together that precautions of this description are indispensible, vinegar is used for this purpose in large quantities; and our plate represents the machine employed as better than plunging the iron into the liquid, to convert the liquid into vapour. It consists of a lamp and an earthen dish, placed in a japanned tin cylindrical vessel—a precaution which is necessary on board ship, where, in fact, they are suspended when used. It has a little tube, for carrying off the smoke of the lamp. The earthen dish serves the purpose of a sand-bath, and a glass cup, containing the vinegar, is placed in it. Fig. 1 is a representation of the apparatus ready for use; Fig. 2 is the earthen vessel and glass cup employed; and Fig. 3 shows the instrument dismounted. A variety of other substances besides vinegar have been employed for the same purpose; and Dr. Carmichael Smith received a reward of 5000l. from the government for his method of purifying the air of ships and hospitals by the fumes of nitric acid gas. The French chemist, M. Guyton Morveau, proposed muriatic gas for the same purpose; but we believe nothing is so effectual as promoting the circulation of atmospherical air. This subject is, however, now so well understood, that the air of a a well-regulated hospital, or of a well-ordered ship, is as pure and as free from offensive smells as the air of any ordinary apartment.

CHEMISTRY AS A SCIENCE.

Art. XVII.

BISMUTH. MERCURY.

The first of these is a metal very sparingly diffused, of not much value, and of little use. Its ores are found chiefly in Germany, and are a compound of the metal and either sulphur or oxygen. It is also found native. To procure the metal from the ores, they are exposed in shallow pits to heat in contact with fuel. The metallic matter which collects at the bottom is then mixed with an equal weight of black flux, is put into a crucible and covered, to about the depth of an inch, with common salt. A strong heat is applied, the mixture fuses, and the metal, known by the name of bismuth, collects at the bottom of the pot. It is of a yellowish or reddish white colour, little subject to change in the air. It is somewhat harder than lead, and softer than copper, and scarcely malleable, rather breaking to pieces than spreading out when struck with the hammer. It melts at 480° Fahrenheit; at a still higher temperature it burns, and forms an oxide called flowers of bismuth. This metal was not at all known to the ancients, but the Germans became acquainted with it in the 16th century. It was supposed to be silver in a growing state, and not yet arrived at perfection; it was also classed as a species of lead; but at length it was decided that it is a peculiar metal, and the attempts since made to reduce it to any other elements have failed. Bismuth is employed with alloys of other metals to make printers' types; it also enters into the composition of some pewters. It has the remarkable property of making other metals fusible, and hence it is used for making solder. An alloy, composed by fusing together bismuth eight parts, lead five, and tin three, will melt at the temperature of boiling water, which affords an opportunity of putting a joke on those who are ignorant of this circumstance. This alloy is formed into spoons, which look exactly like pewter; but to the surprise

and confusion of those to whom they are given, they melt and sink in a lump to the bottom the instant they are immersed in hot tea. Bismuth is also, though rarely, used as a medicine. An oxide of this metal, called *pearl white* by perfumers, is used by the ladies to make their skins look fair and smooth. It is a very favourite cosmetic, but its use ultimately injures the skin; though those who trust entirely to their toilet for their charms do not mind this, as they know the same art which does the mischief can always repair it for their momentary purposes. It is also liable, which is a much worse fault, to turn black when it comes into contact with sulphuretted hydrogen gas, and with some other substances that are occasionally generated where coal is burned and people crowded together; so that it has happened, that she who went into company the fairest of the fair, has come out of it, to her sad mortification and dismay, the tawniest of the tawny.

Mercury, or quicksilver, is a better known and more useful metal than bismuth, and seems to have been familiar to the ancients, who employed it for some of the purposes for which the moderns still employ it. Native mercury has been found in small quantities in Peru. An ore called native amalgam, or mercury and silver, is found in great quantities in the same country, and it has been found in Hungary. There is a third ore, which consists of mercury, muriatic acid, and sulphur. What is called the hepatic ore, a compound of mercury, sulphur, and carbon, also known by the name of cinnabar, is the ore from which the metal is chiefly extracted: it is found in various parts of the world, but Spain and Hungary are the chief places in Europe where it is procured. The mine in the former country is situated at Almaden, and is so prolific that more of the metal has been at times obtained than could be sold. The famous quicksilver mine of Guanca-Velica, in Peru, is 480 fathoms deep, and of such extent as to have whole streets formed in it, as well as a chapel, where religious ceremonies are celebrated, —formerly the only consolation of the thousand naked Indians who were annually driven into the mine to perish by the most miserable of deaths. Those who are obliged to live there are affected by the convulsions, which inhaling mercury never fails to produce; and thousands, perhaps millions, of poor Indians fell a prey to the ruthless avarice of the Spaniards. Things are somewhat better now; but the manner in which the United States of America have outstripped the Spanish colonies in the same country, though blessed with a better soil, is a triumphant proof of the *utility* of *justice*, and one of the strongest recommendations nature ever put on record for men to seek wealth by their own industry, and abstain from oppressing their fellow men.

The following method is employed to obtain mercury from cinnabar in Spain. The ore is divided into three portions: one containing the most metal, the second containing less metal, and the third is the powder which falls from the other two. A furnace is provided, consisting of a long horizontal building, divided into two compartments by a horizontal grating of iron. On this is placed flat rough stones, and on them the second sort of ore is first laid, which is covered by a layer of the ore containing the most metal, and over this another layer of the second ore is laid; above all comes the third sort of ore made into a sort of bricks with clay kneaded and dried; wood is then kindled in the lower part of the furnace, by which the moisture is first driven off, afterwards the sulphur begins to burn, and the heat of its combustion volatilizes the mercury, which is condensed in a receiver attached to the furnace. It is afterwards separated from the soot by placing both on an inclined plane, when the mercury runs off; a good deal of it, however, still remains with the soot, and is thrown away with it. In

Germany, the mercury is distilled from iron retorts, in which it is put with lime, and is condensed in a receiver constructed for the purpose.

Mercury thus obtained is of a white colour, somewhat bluer than silver, but so like it that it was called *quicksilver*. It has no taste nor smell, and is very brilliant. It is distinguished from all other metals by its extreme fusibility, which is so great, that while other metals require the strongest heat of our best furnaces to liquefy them, mercury is always fluid at the common temperature of the coldest climates which man can inhabit. It does not take the solid state till the temperature is diminished to 39° below 0 on Fahrenheit's scale. This circumstance, combined with the fact of its extension by heat being very equable or regular, renders it one of the best known materials for measuring temperature. Thermometers therefore are, in general, constructed of it. Mercury boils when it reaches the six hundred and fifty-sixth degree, and may be distilled over, like water or spirits. This is frequently done to purify it from other substances. Mercury also rises in vapour in small portions at the common temperature of the atmosphere, particularly in a vacuum. Its vapour is elastic and invisible like air, and possesses such force, that an iron globe in which some of it was inclosed being heated red hot, the globe burst with all the violence of a bomb, and the whole of the mercury was dissipated. Solid mercury extends under the hammer, but to what degree is scarcely ascertained. At Hudson's Bay, by taking proper precautions, it was beat into sheets as thin as paper. The specific gravity of mercury is, when fluid, 13.568, when solid 14.465, there being only gold and platinum which are heavier. At the same time, it is so extremely divisible, that it may be strained through the pores of leather; and this is frequently done to separate it from other substances. If adulterated, however, with lead and bismuth, even to one-fourth of its bulk, the whole will thus pass and the adulteration remain undetected. Mercury readily combines with most of the metals, forming amalgams. It also combines readily with oxygen, forming two oxides, one black, called *ethiops per se*, the other red, called *red precipitate*, or *precipitate per se*, and which is much used as a caustic, or escharotic, it destroying the skin or flesh. Mercury also combines with chlorine, and forms *corrosive sublimate*, or *deutochloride of mercury*, which is used in medicine, and is a most virulent poison, and *calomel*, or *protochloride of mercury*. Thus the reader will see that, independent of those various uses he knows of for mercury in its metallic state, such as making barometers and thermometers, silvering mirrors, &c. it forms one of the most powerful and useful, but dangerous medicines man has ever discovered. Mercury is also used in separating gold and silver from other substances; and as this is both a curious and an instructive process, when we come to treat of those metals, we shall describe it.

SOUND HAS NO VELOCITY.

To the Editor of the Chemist.

Sir,—In one of your earlier Numbers you stated the result of some experiments made in Holland, on what you, as well as others, call the *velocity of sound*. In the last Number of the Philosophical Magazine, I observe there is an account given of some experiments by Dr. Gregory, which are styled by this philosopher to be on the *velocity of sound*. Now, Sir, with your permission, I will endeavour to show your readers that this is an absurd mode of speaking, and that sound has no velocity. Dr. Gregory, as well as the people he employed, looked at their watches or other instruments for measuring time, when they *saw* a flash, and they marked by these instruments the interval which elapsed before *they heard sound*. Sound, therefore, was what they heard, the sensa-

tion they felt, and how that travelled from the *seen flash*, when both existed in the same mind, the learned doctor has not condescended to tell us. In fact, Sir, *sound* means sensation in us, and not its cause; in the same way as sight, or vision, means our sensation, and not our eyes or the light which impinges on them. We never hear of the velocity of vision, because philosophers ascribe vision to *light*, of the motions of which we do hear; and we only hear of the *velocity of sound*, because they have not found out a substantive appellation to which they may attribute this sensation. Their *prosopopœia* was at fault when the theory of *sound* was constructed; and they could not find any pretty little name by which to raise the motions of the air to the dignity of a separate being. The cause of sound is supposed to be vibrations of the atmosphere, affecting the tympanum of the ear, and thus producing in us the sensation. There may be a rate of velocity at which these vibrations circulate; but there can be no more velocity in the *sound* than in the mind, where alone it is felt, and where alone it exists. This is, therefore, a very incorrect mode of speaking, and I object to it as leading to incorrect conceptions and incorrect conclusions. When scientific men, led astray by their own uncouth phraseology, set about making experiments to ascertain the time which elapses from the moment powder flashes from a gun, and the exciting of a sensation of sound at a certain distance, by supposing the *sound* is what travels they are obviously led to conclude that it travels at the same rate, let it, namely, the sound, be produced by whatever it may. If, however, there is no *sound* to travel, but vibrations of the air to circulate, it seems natural to suppose that these vibrations will move quicker or slower as the first impelling cause is quicker or slower; and thus that the vibrations caused by the sudden and rapid flash of exploding powder would spread with somewhat greater rapidity than the waves of air set in motion by the tinkling of a bell or the stroke of a hammer. I observe, indeed, in some of Dr. Gregory's experiments, that the sound is said to have had rather a greater velocity when the bell was tinkled than when a gun was fired; but Dr. Gregory makes an allowance of one-fifth of a second, or nearly 220 feet in a second, for the time that elapsed between one man hearing the clapper of one bell and sounding another which he held in his hand, ready for the purpose. In such experiments, I consider an allowance of this kind, as well as the circumstance which made it necessary, to be of such a nature, depending, as that did, altogether on the quickness of perception and execution in an individual, as to vitiate the whole result. There is no proof, therefore, in these experiments, that the vibrations of air, set in motion by sounding a bell and by exploding powder, always move with the same velocity. In the early part of his paper, Dr. Gregory gives the results of the experiments of other persons, eminent philosophers, too, on what they also are pleased to call the velocity of sound, and they vary between 1474 and 1107 feet in a second. The doctor's own experiments give results varying between 1112 and 1094 feet in a second, which seems to show that precision is not yet attained. This varying result, Sir, tends to confirm the supposition, that the vibrations of air circulate with a different degree of rapidity as the impulse which sets them in motion is greater or less. Having thus shown, Sir, I trust, that the phrase "Velocity of sound" is a very erroneous one, and that using it leads men from a consideration of the problem to be determined, namely,—The velocity with which the cause of our sensations of sound, supposed to be vibrations in the air, moves, I hope Dr. Gregory, in continuing his experiments, and other philosophers who may think the same subject worthy of their attention, will not again

use the same phrase, and will set about ascertaining, not the velocity with which a sensation of sight is followed by a sensation of sound, but the velocity with which vibrations of the air, producing sound, circulate.

I am, Sir,
Your obedient servant,
BISHOP BERKELEY'S GHOST.
London, July 1.

We have inserted this communication of our Correspondent, because we do entertain an opinion that many scientific modes of expression are metaphysically and philosophically incorrect. We cannot, however, congratulate our Correspondent on his possessing the acuteness and knowledge of the great man whose name he has assumed. Bishop Berkeley's Ghost should have known, like the bishop himself, that it was long ago shown, that whatever may give the first impulse to the air, the vibrations, to use his language, or, to use the language of men of science, the sound always travels at the same rate. Whether or not the *fact* of its requiring equal times to excite at equal distances the sensations of sound produced by the blow of a hammer and exploding gunpowder, is consistent with the theory of *vibrations* producing sound, when in general vibrations extend with a rapidity in proportion to the first impelling cause, we will not determine; but Bishop Berkeley's Ghost should have known that this fact was established by the experiments of Sir Isaac Newton. We beg that our metaphysical Correspondent, therefore, will make himself better acquainted with the facts of science before he again honours us with his crude suggestions.--ED.

MORE POISONS.

THERE is no wonder so great as the continued existence of the human race, and a mere glance at the armoury of death must satisfy every man that we all bear "charmed lives." The most violent poison which is known, says a French author, is the hydrosulphuric acid, or sulphuretted hydrogen gas. This kills by coming in contact even with a small part of the skin. M. Chaussier, who was the first to make known this phenomenon, put the foot of a rabbit into a bladder containing this gas, which had no communication with any other part of the body, nor was it possible for the animal to breathe it; he died, however, in a very few seconds. The least quantity of this gas introduced into the air we are to breathe causes instant death. A horse which breathes air, of which the eight-hundredth part only of its volume is composed of this gas, dies instantly. This gas, and the hydrosulphuret of ammonia, which is almost as virulent a poison, are both disengaged from the putrid fermentation of common sewers, stagnant waters, &c. Must we not repeat, then, we that bear "charmed lives."

POISON IN THE VIOLET.

M. Boullas has announced, that he has discovered an active, acrid, bitter alkaline principle in the violet, similar to *emetine*, and which he proposes to call violine. It is extracted from all parts of the plant, and is said to be extremely poisonous.

JALAPINE.

Mr. Hume, jun. of Long-acre, has discovered a vegetable alkaline principle in jalap, which he proposes to call jalapine. It is without any perceptible taste or smell, and heavier than morphia, quinina, or other substances of this class; it is scarcely soluble in cold water, and only sparingly soluble in hot ether.

PERKINS OUTDONE, OR NEW INVENTIONS.

A SMALL vessel, the machinery of which, furnace and all, occupied only three feet in length and two and a half in width, and without a boiler, was witnessed, on the 10th ultimo, at Philadelphia, driving a a common ferry-boat, with twelve passengers, at the rate of eight miles an hour. It is the invention of Mr. Hawkins; and if the cylinder, which is only seven inches in

height, had been a foot high, it is said that the power would have been doubled. It is proposed to call this mode of navigation "The Steam-boat Safety," not being liable to bursting or scalding. It must speedily supersede all other steam-engines.—*American Paper.*

MR. TAIT'S INVENTION DISPUTED.

To the Editor of the Chemist.

Leeds, June 29.

Sir,—In perusing your Chemist of the 19th June, I see you have given your readers a plan of a gasometer, purporting to be an invention of Mr. Tait's, of Mile-end-road. A particular friend of mine has had one of the same construction in actual operation for some time. Will you, through the medium of you Chemist, inform your readers at what time Mr. Tait's gasometer was first erected, that we may give to each individual the honour that is due to him for such an important invention.*

I am, Mr. Editor,
Yours respectfully,
J. R.

CHEMICAL SOCIETY.

To the Editor of the Chemist.

Sir,—In consequence of the notice inserted in The Chemist of Saturday, June 26, a number of gentlemen assembled at my house, for the purpose of establishing a Chemical Society; but it being considered by them, that many others who have professed themselves friendly to the cause would be prevented from obtaining the address in time to attend, it was therefore proposed to adjourn to Thursday, 15th July, when the presence of every gentleman favourable to the intended Society will be desirable.

Any information respecting the Society I shall be happy to communicate, either through the medium of your valuable Journal or by post.

I am, Sir,
Your obedient servant,
W. Jones.

Mr. Jones is quite right in supposing his former note did not reach us in time.—Ed.

TO MAKE FIRE FROM WATER.

Pour a little clean water into a small glass tumbler, and put one or two pieces of phosphoret of lime into it; in a short time flashes of fire will dart from the surface of the water, and terminate in ringlets of smoke, which will ascend in regular succession.

TO CORRESPONDENTS.

R. C. may rely on our discretion. His manuscript shall be carefully destroyed.

Chemicus Ignoramus in our next. We should, at the same time, beg leave to ask him, if he is sure he has stated all the circumstances which could have an influence on the phenomenon he describes?

A Subscriber and Reader is informed, that we have never ourselves had occasion to put the practice we described to the test of experiment; but it is recommended by such excellent chemical authority, that at present we have no doubt of its efficacy. It is indispensible, however, that the sulphuric ether should be quite pure, and that it should be well washed with water before being used. Taking this precaution, we are disposed to think Pelletier, Thompson, and Ure have not all asserted what is incorrect.

We are much obliged by the ready manner in which A D* has taken our hint; and as we intend to give rather an extensive account of distillation, we will, with his permission, make use of the information he has given us in our own way. We shall take an early opportunity of profiting by the other part of his offer.*

Problematicus in our next.

Anti-Stahl's letter is very well written, and very flattering to ourselves. It will be inserted in our next; but we could have wished its object had been more definite.

*** *Communications (post paid) to be addressed to the Editor, at the Publishers'.*

* We hope Mr. Tait will make our Publication the medium of conveying the intelligence desired to our Leeds Correspondent.

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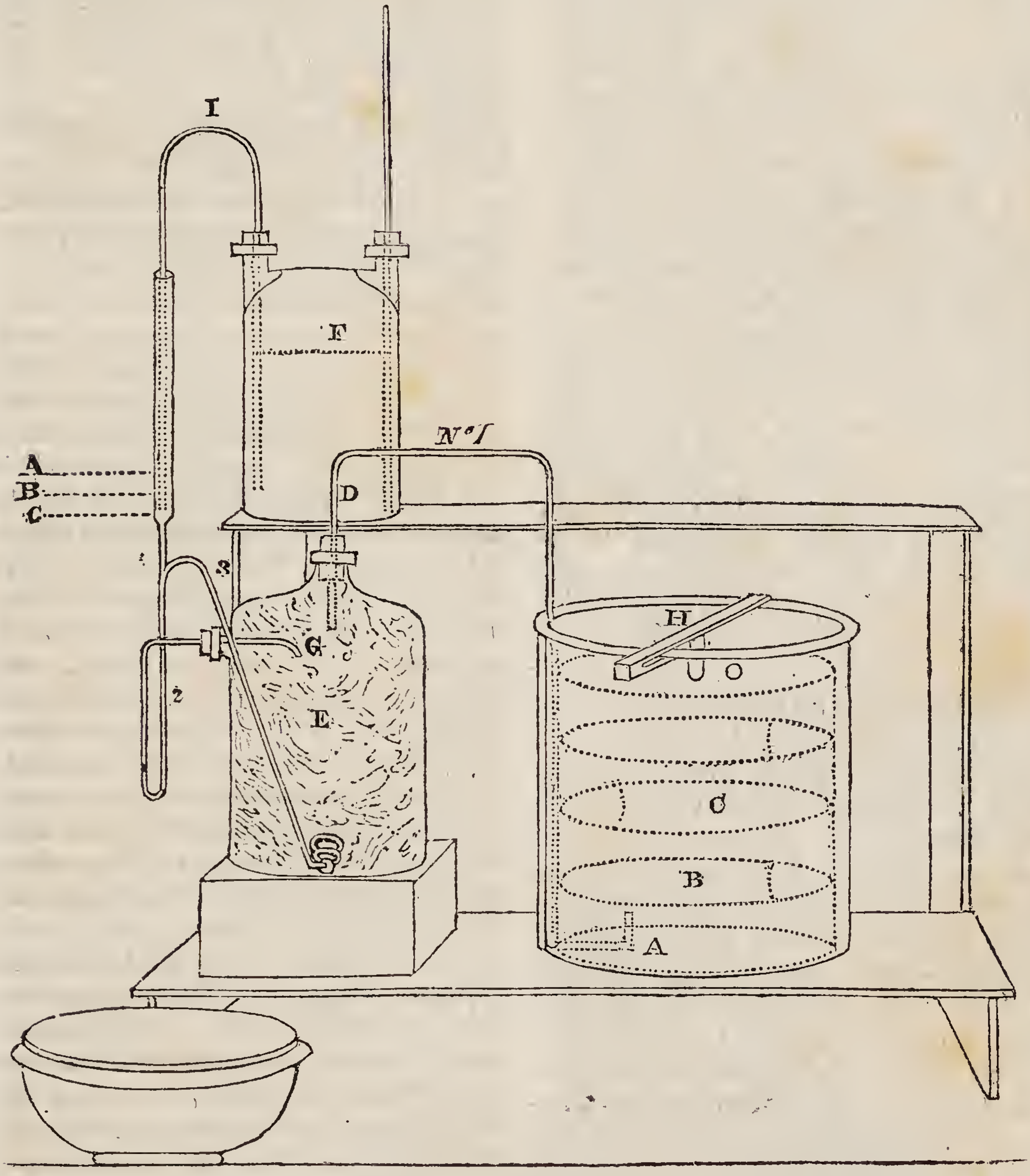
The Chemist.

"—— Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. XIX.] SATURDAY, JULY 17, 1824. [Price 3*d.*



CONTENTS.

WELTER'S SELF-ACTING APPARATUS FOR COMBINING GASES WITH LIQUIDS.

Description of the Plate.

Welter, says the French author from whom we borrow this description, displays genius in all his inventions, and he has found out a very convenient apparatus for the preparation of the saturated carbonates, which also answers for many other purposes. When this apparatus is once prepared, the operation goes on of itself, without requiring the aid of the operator till the materials are exhausted, and without the loss of any gas. The vessel, E, provided with three mouths, one below and two above, is filled with marble broken into pieces. With each of these mouths bent tubes are connected, as seen in the plate. No. 1 is to carry the carbonic acid gas to the bottom of a tub, filled with a concentrated solution of carbonate of potass; No. 2 is to convey, by a small opening, G, the acid to the carbonate of lime; No. 3, by giving it the proper degree of inclination, is made to carry off the solution of muriate of lime as soon as it reaches a certain height. A mixture of equal parts of water and muriatic acid is poured into a vessel with two mouths, F. The precaution of adding the water is necessary to prevent the muriatic acid mixing with the carbonic acid and altering the saturated carbonate. A straight tube is fixed to one of the mouths of F, and a syphon to the other. A B C H is the apparatus for promoting the solution of the gas produced. We see no reason why Mr. Clement's absorbing cascade might not be applied if more convenient. The apparatus used by Welter consists of a large tub full of water and several dishes, or rather small tubs placed in it upside down, and fixed, at certain distances, to each other. The gas is conveyed by means of a bent tube from the vessel, E, to A, the bottom of the tub, where it is exposed to all the pressure of the liquid in the tub. Each of these dishes has, at one part of its circumference, a hole cut across, that side of the dish being somewhat lower than the other, and the holes in each alternate dish are at opposite sides of the tub. In consequence of this mode of arrangement, when the lower vessel is filled with gas, it begins to escape by the hole and fills the next dish, and so on through all the others. By this means the gas is brought into contact with a large surface of the liquid, and kept so for a considerable time. These different dishes being preserved in their places by the cross piece, H, to the underneath part of which a projecting knob is attached and presses on the upper dish; a quantity of muriatic acid, diluted with an equal quantity of water, is poured into the tube, No. 2, whence it flows into E; carbonic acid is immediately disengaged, passes into the dishes, and raises the level of the solution of potass contained in the tub. Care must, therefore, be taken, in the first instance, not to put more in the tub than it will contain after receiving the gas. When carbonic acid gas is no longer absorbed it ceases to pass over, and the acid solution remains stationary in No. 2. Let us suppose it at A—it will then be necessary to introduce into No. 2 the syphon, I, the short leg of which goes to the bottom of the vessel, F. The end of the right hand tube, D in F, ought to be lower than the level of the liquid, A, and higher than the lower part of the syphon, C. By blowing into the right hand tube the syphon is filled with the solution of muriatic acid, and it continues to flow into the syphon as long as the air in F is compressed; but in a short time it dilates, the liquid ceases to flow, and mounts one or two lines up the right hand tube. As the liquid in the tub absords the gas its level falls, and the liquid in No. 2 also descends equally. When it is on a level with the point, D, the air re-enters the right hand tube, bubble after bubble, a fresh quantity of acid runs off by the syphon, and this augmented pressure causes a small quantity of muriatic acid to flow on to the marble. Thus the

muriatic acid cannot reach the marble, but as the carbonic acid is absorbed by the solution of potass; or by the liquid in the tub, and nothing is lost. This apparatus is said to work very regularly, and well; and we have thought it worth making known to our readers, as it seems a useful method for making liquids absorb gases when pressure cannot be conveniently obtained, and when the product is not required in a hurry. The apparatus wastes no time; for, after it is once set in motion, it goes on of itself till the muriatic acid is exhausted, or till the solution is saturated.

ANALYSIS OF SCIENTIFIC JOURNALS.

ANNALS OF PHILOSOPHY FOR JULY.

(*Concluded from* p. 278.)

After the biography of Gahn comes Thomas Weaver, Esq., M.R.I.A., M.R.D.S., M.W.S., M.G.S., H.M.B.I., "On the Older Red Sandstone Formation," &c. This is one of the papers which are more curious than useful. For the thousandth time, we believe, or perhaps the ten thousandth, the author remarks on that imperfection of human nature which leads men to draw general conclusions from imperfect data; and, like all those *preux* philosophers who commence with this sapient introduction, he immediately afterwards jumps to a general conclusion (as far as we can see) not warranted by the data. The only part of the article, which is a jumble of remarks on, and quotations from, Mr. De la Beche, M. Omalius d'Halloy, Dr. Boué, Humboldt, Werner, M. Beaunier, M. Du Bosc, M. Bonnard, &c., that is at all amusing, is the following sentence: "Continental and English geologists thus mutually assist in elucidating the *positions* of each other;" which means, we presume, as the researches of these gentlemen are all directed downwards, that some of them are stuck in the mud, while others are employed in holding a light to show them how to get out. But we must leave Thomas Weaver, Esq., with all those letters after his name, the meaning of which we cannot conjecture, to elucidate his grammatical position himself, and have only to recommend him in future to write English, though it be vulgar.

Mr. South is acknowledged to be a great calculator and astronomer, and occupies, as usual, in the present Number of the Annals, six or eight pages with his tables of correction in right ascension; which are, we have no doubt, very useful to astronomers.

This is followed by a paper "On the chemical composition of Red Silver Ore, by P. A. Von Bonsdorff, translated from the Swedish," in which the author, like a garrulous old man, details all the mistakes he committed before he accomplished his analysis. The result was, that the dark red silver ore of Andreasberg contains in 100 parts, 58.949 silver, 22.846 antimony, 16.609 sulphur, 0.289 earthy matter, 1.307 loss. Mr. Children's "Observations on the use of the Blow-pipe," we think worthy of being transcribed:—

"The blow-pipe, when skilfully handled, is the most convenient chemical instrument for mineralogical researches on a small scale, that has hitherto been invented. By its means we are enabled in a few minutes to determine the principal ingredients in any mineral submitted to our examination, even though it be composed of several elements. By merely directing the flame of a small lamp on a fragment about half the size of a pepper-corn, supported on a piece of charcoal, or in the platina forceps, most of the volatile substances, as sulphur, arsenic, zinc, cadmium, antimony, bismuth, and tellurium, may be detected; baryta will be known by the greenish-yellow, and strontita by the crimson colour it imparts to the flame. By employing only three fluxes, carbonate of soda, borax, and the triple phosphate of soda and ammonia (salt of phosphorus,) with the occasional use of the nitrate of cobalt, we can readily ascertain the presence of

silica, alumina, magnesia, and almost all the fixed metallic oxides; and by the further examination of the fused globule, especially that with carbonate of soda, by dissolving it in a drop of muriatic or nitric acid, on a slip of glass, and applying the proper tests, unequivocal evidence may be obtained of the presence of any of the other earths or oxides of which the substance is composed, and even a tolerable estimate may frequently be formed of their respective proportions. By substituting nitrate of baryta as the flux, and using a slip of platina foil for the support, instead of the wire, the presence of either of the alkalies may, by the usual well-known processes, be detected, with equal ease and certainty, on the same minute scale of operation.

"An advantage peculiar to this microscopic chemistry is the very small quantity of matter that is sufficient for examination, which may generally be detached from rare and costly specimens without injury, whereas for operations on a larger scale, it is necessary wholly or in great measure to destroy them. When the exact proportions of the ingredients of a mineral are required, recourse must necessarily be had to more elaborate processes, but even then previous examination by the blow-pipe is of essential service, since, by indicating the different substances present, it enables us to determine the most advantageous method to be adopted in the subsequent analysis."

An abstract of a Report on M. Rousseau's memoir respecting a new method of measuring the power of bodies to conduct electricity, by M.M. Ampere and Dulong, as well as M. Bequerel's paper "On Electromotive Actions," &c., we have ourselves long ago passed by in the French Journals, from which they are taken, as papers nearly destitute of interest. Having occasionally attended the meeting of learned corporations, and looked into their memoirs, we came very early to the conclusion, that their archives are the repositories for every thing dull,—for every thing that has no interest for mankind is of no utility, and cannot be *sold*,—and therefore it is no recommendation to a paper, that it has been, like the present two, reported on by a committee, even of the Institute of France.

C. H. Pfaff, in the next paper, shows that aqueous vapour deoxidates various substances, and supposes it possible that this fact may be applied to some practical purpose. The Annals concludes, with the exception of some scientific notices, with a very good critical paper, by Mr. Smithson; but as it refers to a geological subject never yet alluded to in the CHEMIST, and touches on rather a delicate topic, "collating the revered volume with the great book of Nature," we must pass it over, by acknowledging that it displays acuteness. On the whole, we must say the Annals is somewhat improved, and seems to have felt that impulse which our scientific literature has lately received.

SELF-ACTING BLOW-PIPE.

IT is pretty generally known, that bottles of Indian rubber may be expanded to a considerable size by condensing air into them; but Mr. H. B. Leeson is the first who has applied bottles so filled to the purposes of a blow-pipe. The bottles he makes use of vary in weight from a half to three-quarters of a pound, and may be readily procured at any stationer's.

"To prepare them they should be boiled in water till completely softened, which, if they are put into water already boiling, will generally be accomplished in ten minutes or a quarter of an hour. They must then be taken out and suffered to cool, when a brass tube may be fitted into the neck of the bottle, having a small cork screwed into it at one end, by which it may be connected with the condensing syringe, and to which the blow-pipe jets may be attached. There should be a milled projec-

tion on the side of the tube for the purpose of more firmly attaching the bottle to it, which may be effected by passing a ligature of waxed string round the neck of the bottle on each side of the above-mentioned projection. The bottle must next be filled with condensed air. After a few strokes of the syringe, a blister will be observed to form, which will gradually enlarge till the greatest part of the bottle (which must be selected uniform in substance and free from defects) has extended to a similar substance. The condensation should not then be continued farther. Bottles of the size I have mentioned, will generally extend from 14 to 17 inches in diameter without bursting, and I have occasionally extended them much beyond these dimensions; but in this the operator must, of course, be entirely directed by his own observations. The Indian rubber varies in its quality: there is one sort which appears of a blacker hue before extension, but becomes very thin and almost transparent on condensing air into it; whilst there is another sort having a browner colour, which is much less yielding in its substance, and cannot be extended to the same thinness as the former. I have found both sorts to answer my purpose; but the above observations may be useful in determining the quantity of air which may be condensed into the bottles with safety. To apply these bottles when filled with condensed air, nothing more is necessary than to remove the syringe, and in its place to screw on a jet of such bore as may be required. On opening the cock, the air will be expelled by the elasticity of the Indian rubber, and its own condensation, in a strong and uniform stream, which, in bottles of the size I have mentioned, will continue from 25 minutes to an hour, according to the size of the jet. When once prepared, the bottles may be constantly expanded to the same size, without any danger of bursting. When the air is exhausted, the bottles will be found somewhat larger in dimensions, but may again be contracted by holding them before a fire, or a few minutes' immersion in boiling water. This, however, is unnecessary, since no subsequent inflation will be found to increase the size of the bottle any further; and I have used the same repeatedly, without any apparent diminution of its elastic powers. The principal advantages of this blow-pipe are its great portability, and length and steadiness of action, (in which I consider it much superior to the hydraulic blow-pipe) together with the perfect liberty at which, when properly mounted, it leaves the operator's hands. This blow-pipe is applicable to any of the gases, and may, I conceive, be applied with advantage to contain the explosive mixture of oxygen and hydrogen, as no inconvenience can possibly accrue from its bursting, beyond the loss of the bottle. This blow-pipe may be supplied with air or gas during an experiment, by having a separate communication for the syringe into the piece of tube before mentioned, and this will enable the operator to continue his experiments for any period of time."*— *Quarterly Journal of Science.*

PREPARATION OF CAOUTCHOUC.

Mr. T. Hancock has succeeded, by some process, the results of long investigation, but which he has not published, in working caoutchouc with great facility and readiness. It is cast, as we understand, into large ingots, or cakes, and being cut with a wet knife into leaves or sheets about one-eighth or one-tenth of an inch in thickness, can then be applied to almost any purpose for which the properties of the material render it fit. The caoutchouc thus prepared is more flexible and adhesive than that

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* Blow-pipes on this construction may be procured, very neatly and conveniently mounted, at Mr. Newman's, No. 8, Lisle-street, Leicester-square.

which is generally found in the shops, and is worked with singular facility. Recent sections made with a sharp knife or scissors, when brought together and pressed, adhere so firmly as to resist rupture as strongly as any other part, so that if two sheets be laid together and cut round, the mere act of cutting joins the edges, and a little pressure on them makes a perfect bag of one piece of substance. The adhesion of the substance in those parts where it is not required, is entirely prevented by rubbing them with a little flour or other substance in fine powder. In this way flexible tube catheters, &c. are prepared; the tubes being intended for experiments on gases, and where occasion might require they should sustain considerable internal pressure, are made double, and have a piece of twine twisted spirally round between the two. This, therefore, is imbedded in the caoutchouc, and at the same time that it allows of any extension in length of the tube, prevents its expanding laterally.

The caoutchouc is, in this state, exceedingly elastic. Bags made of it, as before described, have been expanded by having air forced into them until the caoutchouc was quite transparent; and when expanded by hydrogen they were so light as to form balloons with con-considerable ascending power, but the hydrogen gradually escaped, perhaps through the pores of this thin film of caoutchouc. On expanding the bags in this way the junctions yielded like the other parts, and ultimately disappeared.

When cut thin, or when extended, this substance forms excellent washers, or collars for stop-cocks, very little pressure being sufficient to render them perfectly tight. Leather has also been coated on one surface with the caoutchouc, and without being at all adhesive, or having any particular odour, is perfectly water-tight.

Before caoutchouc was thus worked, it was often observed how many uses it might in such a case be applied to; now that it is so worked, it is surprising how few the cases are in which persons are induced to use it. Even for bougies and catheters it does not come into use, although one would suppose that the material was eminently fitted for the construction of these instruments.—*Quarterly Journal.*

ON PROCURING OXYGEN FROM MANGANESE.

To the Editor of the Chemist.

Sir,—The oxide of manganese of commerce, or otherwise the peroxide of manganese, is very seldom found free from carbon. There are two tests to discover this: first, which is, however, not the most certain, generally the peroxide of manganese, which is crystallized in shining needles, is not carbonated; secondly, reduce the peroxide to powder, and pour on it some nitric acid: if it is carbonated, an effervescence will take place immediately. If the chemist, therefore, wishes to employ such an oxide, he should previously agitate it in an earthen vessel with an excess of dilute muriatic acid. The carbonic acid gas is set at liberty; and as soon as the effervescence is finished, the chemist has only to pour out the liquid, to wash the oxide once or twice with a great deal of water, and then to dry it: it is afterwards fit for use, and will produce very pure oxygen. Without this previous step, on the bottle being heated to a high temperature, the carbonic acid gas would be disengaged during the operation, and would render the result very different from what was expected.

Such, Sir, is the process recommended in this case by several chemists, particularly by Lavoisier and Thenard.

I am, Sir,

Your obedient servant,

July 10. A* D*

QUERIES.

To the Editor of the Chemist.

SIR,—Having succeeded more than once in obtaining abundance of hydrogen gas, I made a balloon of fine tissue paper, which I could fill tolerably well with the common bellows; but when I made an attempt to fill it with hydrogen, my hopes were all frustrated, it would not fill at all. I tried again, but with the same result. I can only account for this, by concluding, that the gas being more subtle than common air, penetrated through the pores of the paper. Now, Sir, I should be obliged to you, or some of your Correspondents, to inform me of the cheapest way in which I could make and fill a balloon on a small scale, to send up without any burden, and whether or not one could be made of paper?

A YOUNG ADMIRER OF CHEMISTRY.

July 9.

Is it possible to find a cement or putty, which could not be attacked by sulphuric acid?

ANSWERS TO QUERIES.

MR. EDITOR,—Having seen several Queries in No. XVII. of The Chemist, I shall proceed to answer some of them to the best of my knowledge.

First, The best method of obtaining sulphur from native sulphuret of iron, upon a large scale, so that sulphuric acid may be obtained from the disengaged sulphur, is by sublimation in large glass or earthenware matrasses or subliming pots, which are placed in large round sand-baths; but sulphate of iron cannot be obtained from the residue, if it be entirely or nearly void of sulphur, for the sulphur is necessary to the formation of the sulphuric acid of the sulphate of iron. But if much sulphur be left in the residue, or if the sulphuret of iron in its *natural* state be used for making sulphate of iron, the operation must be carried on in the following manner:—The sulphuret of iron being broken up, it is to be exposed in one large heap to the air and rain for at least twelve months. The heap should have a channel all round it, with another leading to a large reservoir, in which the solution of sulphate of iron is to be received, and from thence it is to be conveyed to the boilers for boiling it down to crystallize. In this process the sulphur is acidified, and the iron oxidated by the oxygen of the air and water. Part of the water dissolves the sulphate of iron as it is formed, and carries it into the reservoir.

Your same correspondent wishes to know, if heat and light are *really emitted*, or only *reflected* by the sun? This question, I fear, he will not get satisfactorily answered, as there are several theories about it, none of which can be satisfactorily proved. Some have said that the sun merely reflects the heat and light of the earth; others, that it is the primary source of both. Some have even gone so far as to assert that it is a solid mass of phosphorus! In short, it is quite above our comprehension.

Solar light is not different in its nature from the light emitted during combustion, animal decomposition, percussion, or friction.

Should this meet your approbation, I shall feel myself obliged by its insertion, and remain,

Your humble servant,

PROBLEMATICUS.

TO STAIN THE HAIR.

MR. EDITOR,—In reply to your correspondent Prism, I beg to state, that a solution of muriate of gold diluted with water, stains the air of a brown or auburn colour, and this colour is as permanent as the hair.

July 6.

SIMPLE TESTS FOR OXALIC ACID.

(*From a Correspondent.*)

LET a few drops of vinegar be mixed with the solution; if it is oxalic acid its colour will change, if Epsom salts it will not. As it respects the taste, if the tip of the

tongue be applied to the solution the detection will instantly appear, and without danger, for oxalic acid is *strong, hot, and very sour ;* Epsom salts have merely a gentle sort of bitter saltness. Or, dip the end of a piece of dark purple paper (procure it from the grocer's) into the solution ; if oxalic acid, the colour of the paper will change to a bright red ; on the other hand, if Epsom salts, it remains unchanged. Or, dip a silver spoon, or put a sixpence into the solution ; if oxalic acid the colour of the silver will be changed : or if some of the supposed solution be poured on a heated plate of iron, (the fire-shovel will do) if oxalic acid it will, when evaporated, leave a brown sediment ; but if Epsom salts, it will leave a white powder.

BUGS DESTROYED BY STEAM.

Mr. Sealy, of New York, has announced, that steam is an effectual means of destroying this noxious insect. It is only requisite to expose the place where they herd for a short time to the action of steam, and the more the water boils the better ; it kills the eggs as well as the vermin. The employment of this method is both so convenient and cleanly that we think we need say nothing of the mode of applying it, nor by way of recommending it to trial.

POISONOUS CATSUP.

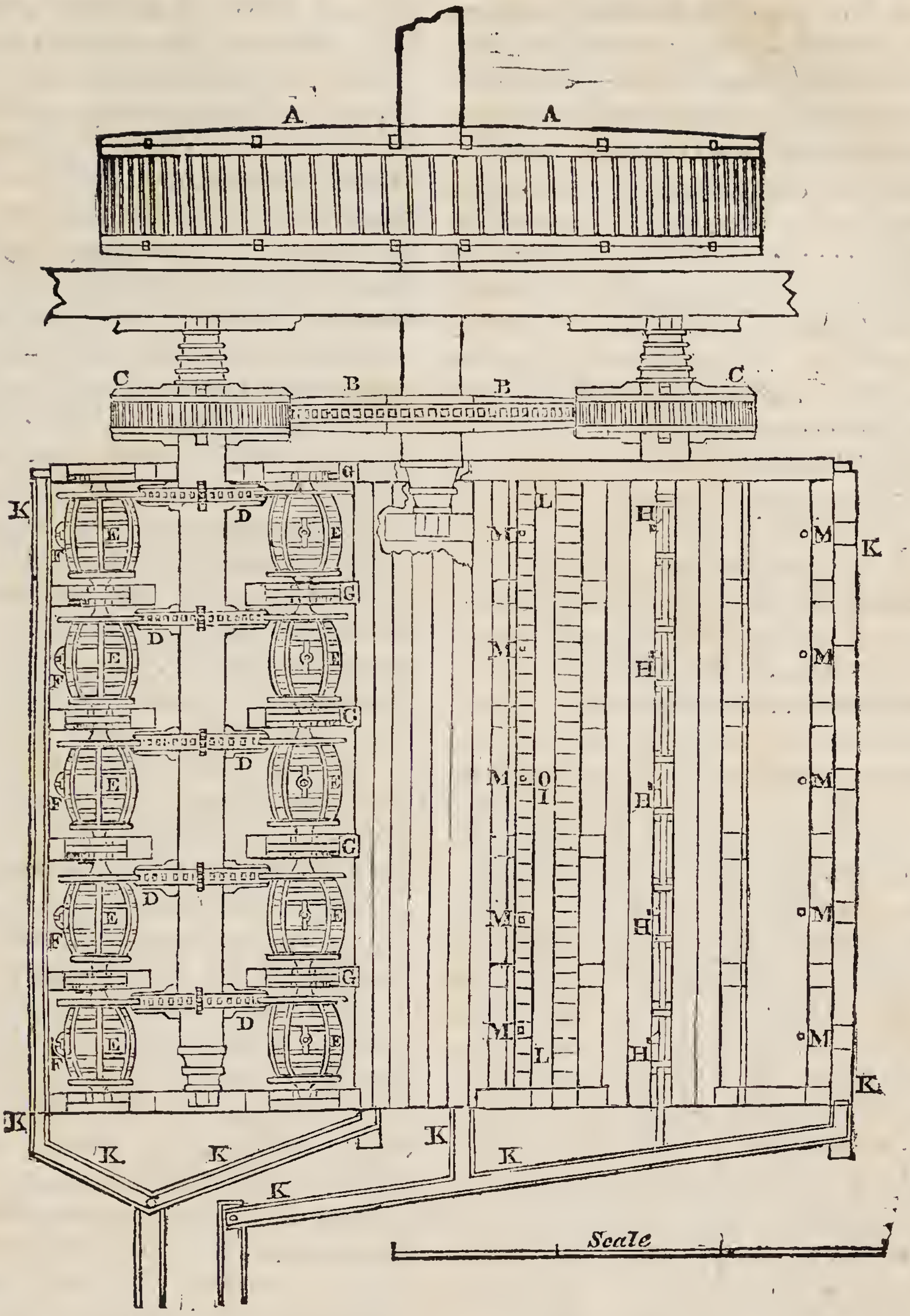
Fish eaters and catsup buyers, look sharp, for you may be taken in and poisoned ! Catsup is, in fact, adulterated in a most reprehensible way. Much of what is sold abounds with copper, which is highly deleterious. After the process for obtaining distilled vinegar has been completed, the residuum is diluted with a decoction of the outer green husk of walnuts ; it is then spiced with Cayenne pepper, pimento, garlic, common salt, and allspice, and sold for walnut catsup. The quantity of poison in this substance is greater than is met with in any other article of food or sauce. Although it is taken in such small quantities as not to be at the moment perceptibly mischievous, yet, in the long run, it is very much so, and from its cheapness, this sauce is very generally used. We recommend lovers of fish, therefore, to adopt Mr. Mariner's method of eating them. That gentleman, from his long residence at the Tonga Islands, acquired an invincible partiality for raw unadulterated fish, which he said were in that state preferable to carp stewed in wine, or turbot swimming in lobster sauce. His recommendation, we are told, has made eating raw fish somewhat fashionable, and as ladies now eat fish with their fingers, (see *Times*, July 2,) there may be some apprehension that we are relapsing into the barbarity of our primeval ancestors, or, what is worse, adopting the customs of the Esquimaux.

TO PREPARE SOLAR PHOSPHORUS.

Cleanse oyster-shells by well washing, expose them to a red heat for half an hour, separate the purest part, and put it into a crucible (a small old flower-pot answers very well) in alternate layers with sulphur, till almost full; expose the vessel to a red heat for one hour at least; when cold, break the mass, and separate the whitest parts for use. When inclosed in a bottle, the figures of a watch may be distinguished by its light.—*Mechanic's Magazine.*

TO PROCURE GOOD WATER FROM SEA WATER.

There have been many attempts made to distil salt water: but it has in general been found that the muriate of lime it contains, being a deliquescent salt, has rendered the water not potable. It is now said, though we confess we have some doubts of the accuracy of the statement, that a Mr. P. Nicole, of Dieppe, has procured palatable water from sea water, by making steam from the latter pass through a stratum of closely powdered charcoal in its way to the condenser.



CHEMISTRY AS A SCIENCE.
Art. XVIII.
SILVER.

There is scarcely a country of the world where this metal is not found, and formerly it was procured to a considerable extent in several parts of Europe. The discovery of mines in America, in which it was much more abundant, and could be worked at a much less expense than in the silver mines of Europe, made it cease to be advantageous to work the latter, and many of them were abandoned. Silver is still obtained in various parts of the Continent; and a small quantity even is got from working lead mines in both Ireland and England. America, however, is the great storehouse of this metal at present; and Humboldt says that the mines in three centuries have afforded 316,023,883 pounds troy of pure silver, which would form a solid globe, 91.206 feet in diameter. But the richest and most productive of these mines is of comparative modern discovery, which gives some countenance to the opinion, that if America were properly peopled, and processes for abridging labour as numerous there as they are here, that silver would be as cheap as copper, and we should all be obliged to have recourse to paper money, as the only means by which we could carry enough about with us for our ordinary expenses. The following is given by M. Brog-

niart, a French mineralogist of considerable celebrity, as the average annual quantity of silver supplied from the undermentioned places, between the years 1790 and 1802:

OLD WORLD.

Asia—	
Siberia	40,200 lbs. troy.
Europe—	
Hungary	46,000
Austrian dominions	11,000
Harz and Hesse	11,000
Saxony	22,000
Norway	22,000
Sweden, France, Spain	11,000
Total, Old World	165,000 lbs. per year.
North America	1,400,000
South America	885,000
Total from Amer.	2,285,000 lbs. per year.

If we multiply this last sum by 300 years, we shall obtain, as the probable supply for the next 300 years, more than double the quantity of that immense load which, according to Humboldt, has been already extracted from America. Notwithstanding this large supply, it would appear to be used and worn out almost as fast as it is obtained; for there is no great accumulation of silver in any part of the world, and the quantity has only,—since the effect of the first discovery of the mines in America has fully taken place,—reduced the value of silver a very little, compared with other commodities. In fact, however abundantly a metal may exist, not its quantity, but the trouble or labour necessary to procure it determines its value relative to other commodities. And as the labour and trouble of procuring silver ore, and separating the metal from other substances, will most probably always be considerable, it will require a large share of other commodities to purchase it. The principal process by which it is obtained at present is very costly, though there is some chance that this may be improved. It is called amalgamation, from being effected by mercury; and as it is a curious process, we shall here give a short account of it.

There are numerous silver ores, but the principal ones are the native silver ore and a mixture of sulphuretted silver and lead. The native silver ore is the ore chiefly subjected to the amalgamating process, and it is employed as the cheapest method for ores that are not very rich. The inventor of this method, it is said, was a miner of Pachuca, called Bartholomew de Medina, and it dates from the year 1557; but some authors say that the Germans were acquainted with it, and practised it, long before that period. In Mexico the metal is first reduced to powder, and, according to M. Humboldt, this operation is there conducted with very great care. After being pulverized, it is sifted through a piece of leather pierced with holes, and again ground by stones moving in troughs. Each mill of this species, called in America *arastras*, grinds from eight to ten hundred weight of mineral in twenty-four hours. If the mine is rich, so much care is not employed in reducing the mineral to powder; it is sufficient if it be bruised of the size of coarse sand. When the *schlich*, as it is called, is thought to be fine enough, it is carried, while yet wet, into the amalgamating yard, which in general is paved with large stones. It is there heaped up in masses of from 20 to 30 cwt., and 40 or 50 of these heaps make what is called a *tourte*. This quantity is then left to itself for a considerable time, after which common salt is added, in the proportion of from 4 to 20 per cent., as the ore is poor or rich; if the ore does not contain, as it sometimes does, pyrites or sulphate of iron, this substance is also added, mixed with sulphate of copper, and finally, lime and vegetable ashes are put on the heap. These different substances are carefully mixed, and allowed to remain together for several days. According to the nature of the ore, their action on one another is different. If it is naturally loaded with the sulphates of copper and

iron, or contains much muriate of silver, the heat generated is too great, and is diminished by a further addition of lime. If much sulphate of lead is present, or pyrites difficult to decompose, chemical action is faint, or does not take place, and must be promoted by augmenting the temperature. Then also what is called magistral, or a mixture of sulphate of iron and copper, is added. The operation is thought to go on well when a portion of the mixture, on being placed in the hand, causes a sensation of heat. A few days afterwards, about six times as much mercury as the tourte is supposed to contain silver, is added, as well as more magistral. If the mercury acquires a leaden colour, the operation goes on properly. In order to expose every part, however, to an equal action, the mass is stirred about in rather an extraordinary way. Twelve or twenty mules are driven round in it for several hours, or a considerable number of barefooted workmen march backwards and forwards in this metallic mud. Every day, the overseer ascertains the progress of the work by washing a portion of the mixture in a wooden bowl, and judging by the aspect of the amalgam. When the mercury assumes the colour of ashes, separates in a grey powder, and sticks to the fingers, the heat is too great, and more lime is added. If, on the contrary, the mercury retains its metallic lustre, or is covered with a red or golden scale, if it does not appear to act on the mass, the heat is increased by adding magistral. Thus the operation, naturally modified by the temperature of the season and by the different species of ore, may be almost directed at the will of the workman. It is, however, a very tedious process, and sometimes lasts five months. When the amalgamation is judged complete, the *mud* is thrown into troughs made either of stone or wood, in which the arms of a mill revolve, so as to stir it, and a stream passes through it; the earths and the oxides are carried off by the water, and the amalgam remains at the bottom, which is put into bags and subjected to gentle pressure. It is then placed in a pyramidical form, is covered with pots of the same shape, and heat is applied all around; the mercury distils off in vapour, and is conducted into trenches and condensed by cold water, to be afterwards used. Mr. Humboldt says, for about every 2lbs. of silver obtained by this process, 3lbs. of mercury are lost. In Saxony, however, where the same process is carried on, though not on so large a scale, about one-fifth only of mercury, for the silver gained, is lost, while the operation seems to be performed in the two-hundredth part of the time.

The principal place where the amalgamation is carried on in Saxony is Freyberg, and there the process is different from that in use at Mexico. After the mineral has been bruised and washed, and carefully separated from all extraneous substances, it is mixed with salt in the proportion of 10 to 100. The salt is first carefully sifted, and the two substances are intimately mixed together, after which they are dried in a room over the furnace. When dry, the schlich is thrown into one end of a furnace, the fire being at the other, and the calcination taking place in the middle. Above the furnace are vaulted chambers, divided into several compartments, where the dust which rises is deposited. After the schlich has been in the furnace about half an hour, it is raked into the centre, where the heat is greater, care being necessary not to make the heat too strong at first, the mixture being constantly stirred, so that no lumps form. The heat is gradually increased, the salt decrepitates with some violence, the sulphur begins to burn, and at length the whole mass is incandescent, and continues so though the fire is withdrawn. When the schlich ceases to burn, the fire is again kindled, and a considerable degree of heat produced. At this period the mixture gives out a great quantity of chlorine, the

smell of which it is difficult to support. The workman takes up a portion of the material from time to time with an iron ladle, and when the smell of chlorine is very strong, he stops the operation and rakes the residuum of the calcined mass bye to cool. In this process, it seems, according to M. Rivero's account, that the sulphurets of the mineral are converted into sulphates, and being decomposed by the heat, the sulphuric acid attacks the salt, forms sulphate of soda, and sets the muriatic acid at liberty, which, acting on the oxides, converts them into chlorides; these are afterwards decomposed, and give out the quantity of chlorine which then becomes so perceptible. When the schlich has been thus roasted, it is again sifted through iron sieves, and the parts found not sufficiently calcined are mixed with more salt and calcined a second time. The part of the schlich which passes through the sieve is conveyed by funnels to the amalgamating casks. In general there are twenty of these in one room, and they are made to turn round by means of machinery adapted to the purpose. About 300lbs. of water is poured into each cask, and then about 1000lbs. of schlich and some pieces of forged iron are put in. The casks are fastened up and turned round for about one hour; 500lbs. of mercury are then put into each cask, and it is firmly closed. The machinery is immediately put in motion, so as to make each cask turn round about 15 or 20 times in a minute. Every four hours the amalgamation is examined; and in about sixteen hours the operation is completed. The casks are then filled with water, and are turned round gently for an hour, when the contents are separated into two parts, the amalgam and the residuum, which latter is again washed, more completely to separate the remaining mercury. The former is subjected to gentle pressure, and the mercury then separated by distillation, when the silver remains. Our plate represents the room where the amalgamation is carried on. A A is the moving wheel; B B is another wheel with 108 teeth, on the axle of A A; C C are smaller cog wheels working to correspond with B, and each of the axles on which they are placed gives motion, by means of cog wheels, D D, to a number of amalgamating casks, proportionate to the size of the room and the quantity of work to be done; E E E are the casks; F F show the half circular piece of iron used in conjunction with a screw to secure the opening of the cask after the materials are put in; G G are also screws, the purpose of which is to enable the workmen to move any of the casks from the contact of the teeth of the wheels, D D, so that it may be worked at without stopping the movements of the other casks; H H shows the situation of an iron funnel or conductor, composed of several pieces, which can be moved in any direction—it serves to convey the mercury into any one of the casks at pleasure; I shows one of the holes through which the residuum, from the amalgamation, passes into troughs to be washed, and have the mercury separated from it; M M are the holes in which funnels are placed to receive the amalgam from the casks, and which convey it into the basins, L L, whence it is carried by the pipes, K K, to the place where the mercury is to be separated by distillation. To give a clearer idea, this plate has been divided into two parts: on the left the casks are shown as they work; on the right, in the middle of the figure, the manner in which the funnel is placed above the casks is shown; while, on both sides, the floor is represented, above which the casks work.

There is another method of obtaining silver from native ores, which is practised at the rich mine of Konsberg, in Norway, and which is extremely simple. The ore is cleansed from the earthy matter as much as possible, and is then melted with an equal weight of lead, from which it is separated by

the process of cupellation, as described in our No. XVI. Where the ore is naturally mixed with lead, which is very often the case, no addition is necessary; in general, however, it contains sulphur and other substances, which are got rid of by roasting after it has been cleaned. As mercury itself is a costly substance, till some other method is found out of purifying silver, however abundant it may be in the Andes, it will never become very cheap.

We need not, we believe, describe the appearance and properties of silver: they are known to our readers from what they possess of it, and perhaps even still more by what they desire. In consequence of money being the representative of all things, it is very generally confounded with wealth, and few men wish for what money will buy, compared to the number who wish for money itself. Silver is equal in brilliancy to any of the metallic bodies except polished steel; it is softer than copper, and harder than gold, and inferior to none of the metals except the latter in malleability and ductility. It can be beat into leaves the thousandth part of an inch thick, and drawn into wire as fine as human hair. Silver can be burnt and dissipated, being converted into an oxide. The various uses, also, to which silver is put are too well known for us even to allude to them. Slightly alloyed with copper, to add to its durability, it constitutes the great mass of the coin of all Europe; and we cannot on the present occasion better take leave of our readers, than by wishing their pockets may never be destitute of this *precious* metal.

IS THERE ANY PROOF OF THE EXISTENCE OF ATOMS?

To the Editor of the Chemist.

Sir,—An article in one of your late Numbers, entitled a "Biographical Notice of Stahl," struck me as one of the strongest proofs, amongst the many we possess, of that disposition which has always existed, to receive any theory, however speculative and theoretical, having the irresistible charm of novelty for its recommendation. Is it not surprising that experience should not have had the effect of teaching us greater caution, and checking, in some measure, this unfortunate disposition? That the phlogistic theory of Stahl should have been so strenuously adopted, just emerging as the science then was, from alchemical obscurity, ought not to excite our surprise; nor should the fact of its having remained uncontroverted for such a length of time, considering the necessarily slow progress of philosophical knowledge, incur our censure. Modern philosophers, in judging the talents and discoveries of their predecessors, are too apt to forget the disadvantages under which they laboured. Stahl, considering the time in which he lived, is as much entitled to our admiration and gratitude, as a contributor to science, as he who, with the advantages of subsequent experience, proved his theory to be untenable; and, be it remarked, the admiration and attachment which was displayed by the philosophers of that day, towards the phlogistic hypothesis, was not more enthusiastic than that with which the antiphlogistic theory (so called) of oxygen was received at its first announcement. The latter was certainly conclusive as to the fact of combustion being an act of combination and not of separation, and consequently decisive, as far as Stahl's explanation of his hypothesis went; the theory, however, which it was attempted to establish on Lavoisier's principle, has been unable to stand the test of experiment—both have been proved to be equally fallacious. Oxygen can no longer be allowed to be the necessary supporter of combustion. As to the real explanation of the phenomenon we are, therefore, still in ignorance. We have also another proof of this speculative and theorising disposition in the substance oxygen, which for many

years was asserted to be the acidifying principle; subsequent experiments have proved that there are substances possessing all the distinguishing characteristics of acids, which are totally devoid of it. Are not such examples sufficient to teach us the necessity of caution? Are they not, in fact, almost sufficient to justify scepticism itself? Yet it appears we are now expected to subscribe to a doctrine, to understand which appears to me to be beyond the limits of the reasoning faculties of man,—I mean the present prevailing fashionable "Atomic Theory." Instead of indulging in personal invective and abuse against those who happen to differ in opinion with him, I wish its strenuous advocate, the great leviathan of philosophical literature, would condescend to favour us with his definition of an atom; I, for one, lamentable as my ignorance may appear, candidly confess myself unable to form an idea of what an atom can be. Erroneous theories, we have seen, often appear extremely plausible; the most absurd, we have also seen, will be sure to find its advocates; and it may be generally observed, that in proportion to its absurdity is the enthusiasm or fanaticism of its supporters. Convinced of the truth of this observation, the manner in which the publication alluded to supports this doctrine tends rather to strengthen my disbelief of it. It is much to be regretted that the illiberal tone of its criticisms, and the constant practice of indulging in ridicule and abuse, should deprive it of that respect with which, as the professed organ of the first scientific Society in Europe, we should be inclined to look upon it. I am happy in being able to congratulate the "Chemist" on the courage and independent spirit it has shown in expressing its censure on such degrading and unphilosophical conduct. ANTI-STAHL.

DICTIONARY OF CHEMISTRY.

ASSIMILATION. The process by which the materials forming the nourishment of animals or plants are appropriated to the different parts of the body, or converted into the different substances of which it consists. Partly this is a chemical process, as the decomposition of the materials can be traced to chemical agents; but the *adapting* or *assimilating* power belongs exclusively to life.

ASTRINGENT PRINCIPLE, *tannin*. A vegetable principle, distinguishable by the taste: it is found in bark, the husks of nuts and walnuts, in green tea, in nut-galls, and various other substances. It is the active agent in converting *hides* into *leather*, hence its name of *tannin*.

ACTAMITE, *a muriate of copper*, which is found native.

ATHANOR. A furnace now fallen into disuse. It was constructed on the principle of supplying itself with fuel.

ATOMETER. An instrument contrived by Professor Leslie, for measuring the quantity of exhalation from a humid surface in a given time.

ATMOSPHERE. The aerial fluid surrounding the earth; chemically, a compound of four volumes of azot and one of oxygen, with a small quantity of various other substances.

ATOMIC THEORY. A prevailing theory of the chemical nature of bodies. It seems to consist in supposing that all simple substances are formed by the union of an indefinite number of precisely similar particles or atoms; and that particles or atoms of simple substances only unite with the particles or atoms of other simple substances in certain definite proportions; and that whenever one simple substance unites with two proportions of any other simple substance, the last proportion is always a multiple of the first. The latter part of the theory, namely, that *all substances* in combining with one another, unite in certain proportions only, that is, unite according to some general rule or law, and not at random or by chance, is what the philosopher would expect *à priori*, and seems

confirmed by experience. The former part of the theory, namely, the *existence of atoms*, is a remnant of a very ancient system of philosophy, and ought, in the country which gave birth to Bacon, and in which the philosophers pretend that the senses are the source of all our knowledge, and that *for us* there are no facts but what they inform us of, to have been long since extinct. All the phenomena we witness may be as well explained without as with the assumption of the *atomic* existence of substances; and we hold the present prevalent theory to be a proof, (unfortunately there are too many extant,) of the continued influence of portions of philosophical theories long after those theories are generally denied and abandoned.

Atropia. One of the newly discovered vegetable principles, which probably belongs to the class of vegetable alkalies. It is so named from having been obtained from the *Atropa Belladona*, or deadly nightshade, and is the poisonous ingredient in this plant.

Attraction, see *Affinity*.

METHOD OF CLEANING GOLD TRINKETS, AND OF PRESERVING ENGRAVED COPPER-PLATES.

Boil the trinkets in water of ammonia, which dissolves the metallic copper of the alloy to a certain depth, so that after the operation, the metal is, in fact, gilded, nothing but pure gold being visible. In this process the waste of gold, which takes place by the application of neutral salt to disengage nitric acid, the usual method of cleaning trinkets, is avoided. Hitherto chemists have neglected to observe, that metallic copper is soluble in ammonia. Dr. M'Culloch has shown, that the solution takes place rapidly at a heat sufficient to boil the water of ammonia. He says, copper-plates are apt to be injured by lying by, a coat of oxide forms on the surface, which is rubbed off by the hand of the workman on the first inking when the plate is again used; and by the re-formation of the oxide, and its being again removed, the fine lines of the plate are soon injured, and ultimately obliterated. To prevent this, he recommends the application of common spirit varnish to the surface, when the plate is laid by: it is easily applied, and can be removed by spirit of wine.—*Edinburgh Journal of Science.*

INFLUENCE OF EVAPORATION FROM THE SURFACE OF THE BODY ON ITS TEMPERATURE.

It has been sometimes asserted, and sometimes denied, that the evaporation from the surface of the human body was the cause why it remained at nearly the same temperature, that of blood heat, though the air around it was much hotter. The following experiment seems to place this matter in a clear point of view:—One of those porous vessels, called an *alcarrazas*, which have already been described at page 205, and which permits evaporation from every part of its surface, together with two wet sponges and a frog, were all placed in an oven, the temperature of which varied between 126° and 142° of Fahr. Before being placed in the oven, the temperature of the alcarrazas and of the sponges was somewhat above blood heat, while that of the frog, like all cold-blooded animals, was considerably below it. In the course of a quarter of an hour the two sponges, the earthen jar, and the frog had all nearly the same temperature, and what is very remarkable, this was about the ordinary temperature of hot-blooded animals; and during two hours all these substances remained at the same temperature. The temperature of the frog, as might have been expected, rose; but the temperature of the sponges and of the jar, quite contrary to expectation, fell; all remained for a considerable period much below the temperature of the stove, and the temperature which they preserved was

the ordinary temperature of hot-blooded animals. "Thus," says Dr. Edwards, from whose book we quote this, "the same general cause, evaporation, is of itself sufficient to preserve the temperature of animals, and of matter, below the temperature of the air, when that exceeds the temperature of warm-blooded animals.

This experiment accounts for the power which man has of bearing the temperature of different climates, and of resisting the enormous heat of some occupations. Thus sugar-bakers, and artisans engaged in other trades, are frequently or, when at work, constantly exposed to a heat far greater than that of the most burning climate of the globe. Thus, too, we are told that Messrs. Tillet and Duhamel, French philosophers, being at La Rochefoucault in 1760, the daughter of a baker went, in their presence, into an oven, the temperature of which they estimated at upwards of 260° Fahr., or far beyond the boiling point of water. She remained in this extreme heat about twelve minutes, without suffering any inconvenience from it. This experiment was afterwards repeated with another girl, with the same result.* At a later period, Dr. Fordyce, the celebrated English physician, remained for a considerable time in a room heated by stoves to the temperature of 260° Fahr. The lock of the door, his watch, and keys lying on the table, burned his hand, an egg became hard, and though his pulse beat 139 in a minute, a thermometer held in his mouth was only two or three degrees higher than ordinary. He perspired profusely; and the experiment showed that the evaporation from the surface of his body, like that from the jugs and sponge, was sufficient, in the midst of this great heat, to keep his temperature on a level with that of the human body on ordinary occasions.

* Mem. de l'Acad. des Sciences, 1764, p. 185.

THE SUN A PATENT GAS LAMP.

Some of our readers will be gratified to hear that M. Arago, a very celebrated French philosopher, a Member of the Institute, Editor of the *Annales de Chimie*, &c. &c., communicated to the Institute, on the 14th ult., some experiments he had lately made on the polarization of light. From them he considers himself authorised to conclude that the luminous part of the sun is nothing else than a gaseous substance in combustion, like the flame of candles. We take this little notice from the *Times* newspaper; and though we should be sorry to impede the lofty speculations of the French philosopher, we should like to ask whence the sun receives the supply of oxygen for the combustion. Can any body conceive the *whole atmosphere* of the earth, or any other planet, in a flame, without asking this question? We admit, however, that it is a noble discovery, to reduce the glorious orb of day to the level of a patent gas lamp.

TO CORRESPONDENTS.

A Young Admirer of Chemistry *will see that we have inserted the essential part of his letter, as we are not acquainted with the* cheapest *way of making a small balloon. The large balloons are made of* muslin *or* lute-string, (*Mr. Graham has made one of* gauze,) *varnished over with a mixture of one part of elastic gum or caoutchouc, cut into small pieces, and thirty-two parts of rectified oil of turpentine, which, before being used, must be strained through a linen cloth.*

The second communication of Chemicus Ignoramus *came too late to permit the Article to be inserted. The additional* fact *mentioned, seems to afford a partial explanation of what otherwise appeared inexplicable.*

Problematicus's *second communication, and* Cat's Paw, *in our next.*

*** *Communications (post paid) to be addressed to the Editor at the Publishers'.*

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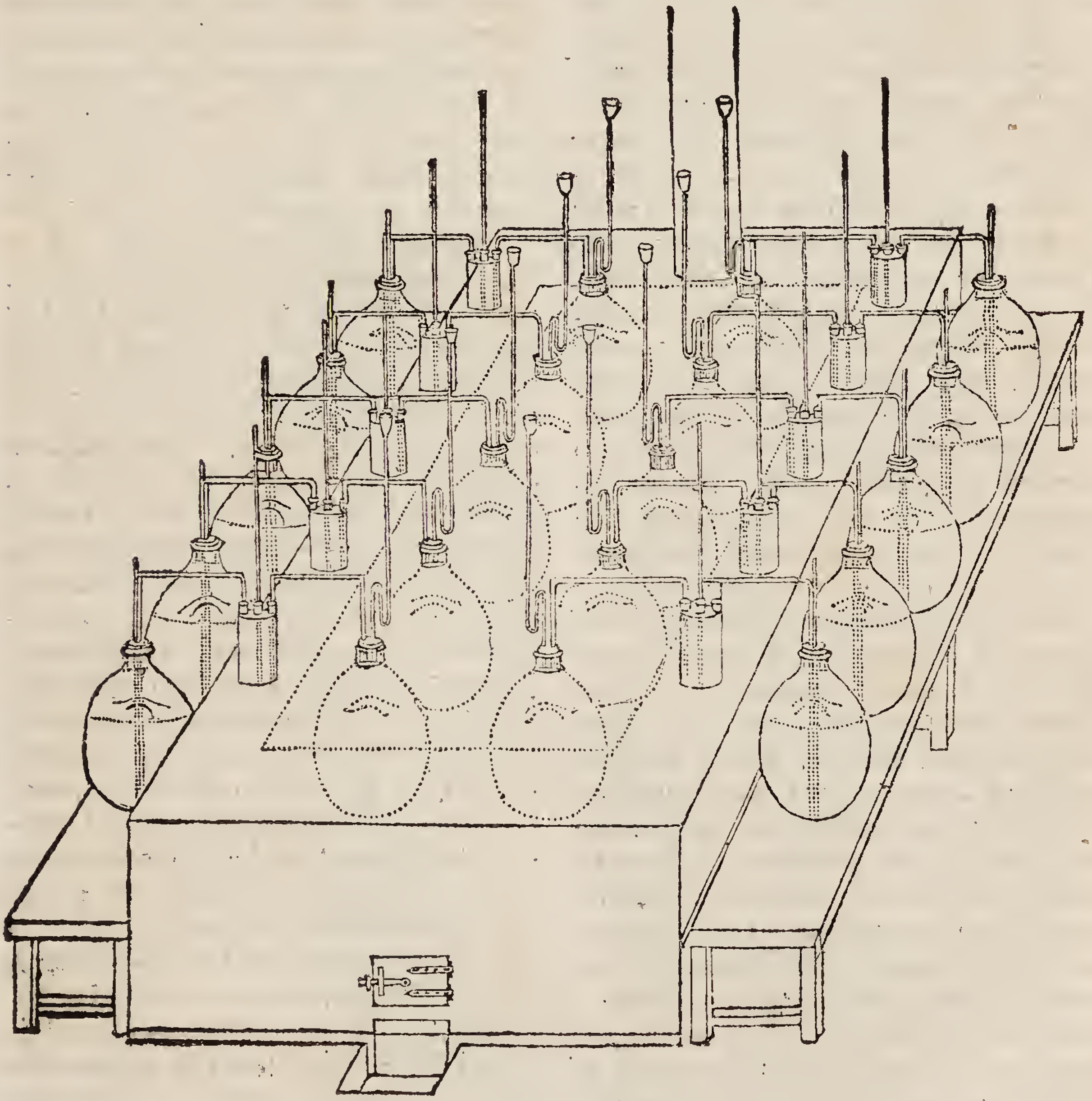
The Chemist.

"——Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. XX.] SATURDAY, JULY 24, 1824. [Price 3*d*.



CONTENTS.

TO PREPARE CHLORATE OF POTASH.

The variety of uses to which this salt is now put, particularly in making those matches which we import apparently in such large quantities from France, induces us to transcribe, from a French work, an account of the method of manufacturing it. A convenient number of coarse earthenware retorts, containing peroxide of manganese reduced to coarse powder, are placed over and around a furnace, as seen in the plate. Each of them has a crooked tube adapted to it, and is placed in communication with a Woolf's flask by means of another tube bent at right angles; and water is put in the flask in order that the passage of the gas may be seen. There is an upright tube of safety, which also reaches a little under the surface of the water in each flask; and a third tube, which does not descend to the water, connects it with the vessel containing the potash. This tube is of large diameter, having its two legs of unequal length; the shortest goes into the flask, and the longest plunges into a large vessel, generally of stone or common glass, containing subcarbonate of potash. A long and very small glass rod, bent somewhat like a hook, passes through the cork of the large bottle, and is made to fit as tight as is consistent with moving. The bent end enters the end of the tube, and the purpose of it is to keep the latter clear of crystals, which are apt to form at its mouth and stop it up. This is the reason, too, why it must be of a considerable diameter. Generally the solution of subcarbonate is made of American potash, which is purified as much as possible, by allowing it to remain for some days in earthen vessels before using it; and it should be concentrated from 30 to 35, according to the temperature of the season. After the apparatus has been made ready, and the joinings carefully luted, a quantity of muriatic acid is poured alternately into every retort, which is repeated when chlorine ceases to come over; and this is continued till all the acid is consumed the operator chooses to employ. As the quantity of chlorine necessary to saturate the potash employed is known pretty accurately, the two are proportioned to one another by the operator, and he pours no more muriatic acid into the retort than will produce chlorine enough to answer this purpose. When all the acid has been added, and the gas has nearly ceased to pass over, heat is applied, but very gradually, and without interruption, till it is perceived that vapour and not chlorine comes over. This is known by the high temperature acquired by the tubes of communication, and by the liquid in the Woolf's bottle being discoloured and augmented in quantity. During the operation care must be taken to keep the tubes clear of obstruction, and to notice the height of the liquid in the safety-tubes, or the operator, in addition to other evils, will be much incommoded by the emission of chlorine. The alkaline solution, into which the chlorine is conveyed, grows at first thick, owing to the silica contained in the potash, which is precipitated as the saturation is effected; afterwards an effervescence takes place, which increases as the operation is continued, and crystals of chlorate of potash are deposited in brilliant scales. It should be observed, that in some places the solution of potash is filtered after the operation has been begun, in order to separate the silica, which is almost wholly deposited at the commencement. This, however, is an inconvenient method, and in general it is better to wait till the operation is over; when, after having allowed the chlorate and the silica to drain well, boiling water is poured on them, which dissolves the salt and leaves the silica. It is then filtered, and the chlorate crystallizes as the water cools. This is the salt the French use to make what they call oxygenated matches; and the process they employ we shall describe in our next. At

present we mean only to observe, that this salt has the property, when mixed with combustibles, of decomposing them with a violent detonation. On this account, Berthollet, the discoverer of it, proposed to use it in making a *gunpowder*, and a manufactory was begun at Essonne, in France; but the very first attempt at making it cost two persons their lives, the project was immediately abandoned, and has never since been revived. We mention this quality of the chlorate that our readers may be cautious how they employ it. It may also be mentioned, that this salt forms the basis of Mr. Forsyth's percussion powder, which is now employed as priming for fowling-pieces.

THE INFALLIBLE BAROMETER.

To the Editor of the Chemist.

SIR,—In No. XVII. of your excellent Work is an account of an infallible barometer, and without giving it the least thought, I went to purchase some *chloride of ammonia;* and when I arrived at Plough-court, I was informed that no such *composition* as chloride of ammonia could be formed; for by attempting to unite its bases, decomposition would take place. There is chlorate of ammonia and hydrochlorate; and I presume, that it is the *hydrochlorate* that is meant, or, to speak in plainer terms, muriate of ammonia, or sal ammoniac. By the insertion of the above you will much oblige,

Yours truly,

Potter's-fields, Horsleydown. T. P.

The Article to which this alludes was taken without much attention from a French journal, which took it from an American scientific journal, into which it had probably been copied from the Mechanic's Magazine, where it appeared, we find, several months ago, and where it was also several months ago proved to be very erroneous. We confess we were caught by the title, not reflecting that claims to infallibility might be in barometers, as well as in churches and women, only pretensions put forth to prevent examination and conceal frailty or error.—ED.

CHEMISTRY AS A SCIENCE.

Art. XIX.

GOLD.—PLATINUM.

GOLD is always found native or in its metallic state; sometimes it is alloyed with copper or silver, and occasionally with tellurium. Some species of pyrites also contain a sufficient quantity of gold to make it worth while to extract it. The most usual forms in which metallic gold is found, are grains, leaves, and small crystals. It is contained in the sands of many rivers, both in Africa and Europe, and is found abundantly in South America and India. France, Sweden, Norway, and Ireland all possess gold. Spain was formerly celebrated for its mines, but the principal places where this metal is now procured are South America, Hungary, and Germany. Though not so abundant as iron, nor so easily procured, it is, perhaps, as widely scattered through the mineral kingdom, and has been certainly as long, if not longer known. At present it is not put to so many uses as iron, nor is it so indispensible for the welfare of man. An experience of twenty years, during which it was rarely seen in England, has shown, too, that its place as money, for which it was considered as the best adapted of all the metals, may be advantageously supplied by a material that does not cost so much to obtain it, and is kept in repair at a much less expense. Theory also has stepped in, and confirmed the observations of experience. According to that, it is only necessary that those who promise to pay on demand, should be under an obligation to fulfil their engagements, or at least should not be exonerated from fulfilling them, to make their "promises to pay," or bank-notes, a better and more convenient money than gold. In fact, gold, as money, has no other utility than representing other commodities;

but it is of itself a very costly thing, while its representative faculty may be equally as well performed by paper, which costs little or nothing. By using paper, which would never have been brought into discredit but for the unjust manner in which those who promised to pay were exonerated from fulfilling their engagements, mankind would save all the expense, which is very considerable, of a metallic currency. Thus, therefore, in alluding to the uses of gold, we cannot say much in its favour as money. The expense of procuring it, however, its great durability, its remaining unaltered when exposed to the action of the atmosphere and to great heats, make it,—after bank-notes, to represent certain quantities of it as that commodity which is least liable to alteration,—the best material we possess for coin. This is, indeed, a most valuable use, and it is as money that gold is most extensively employed. It is, moreover, of considerable use in the arts: though we never can place a gold drinking-cup on a level with a good knife, in point of utility, yet, if the latter is a useful instrument, the former is a graceful ornament, and the severe morality which would lead us to despise trinkets and ornaments, is as unworthy of the approbation of a wise man, as that fashionable sort of humbug which scorns as vulgar every thing useful. One of the most valuable properties of gold, however, seems to be of modern discovery: it forms, in various ways, some of the most brilliant colours and dyes the moderns possess. Without iron the progress of man would be very slow and circumscribed, and without gold life would be less adorned and less graceful.

When gold is found in the sand of rivers, no other process is employed than to wash the sand well with a quantity of water, so that all the lighter particles are carried off. In general, the quantity of metal contained in the sand is so small that this process, though there seems nothing costly in it, requires so much time and labour, as, in fact, to be very expensive. Gold has, indeed, been found so plentiful, that the Spaniards, on one occasion, collected in a few hours upwards of thirty thousand pounds worth. One piece weighed 132 ounces, and was worth 500l.; but such mines are like hidden treasures; and if they were frequent, and could be worked at pleasure, would reduce the value of the metal below that of copper. When gold is found alloyed with silver, and mixed with earthy matter, the ore is first broken into pieces about the size of a nut, separated as much as possible from earthy matter, and afterwards reduced to a fine powder. By the addition of salt and water, this is made into a thin paste, mercury is then squeezed into it through a leather bag, and is intimately mixed with it. The mixture is kept at the temperature of boiling water about three days, when the earthy matter is separated by washing, and an amalgam remains of gold and silver. The mercury is distilled off, and the silver separated by cupellation and *parting*, or subjecting the metals to the action of nitric acid, which dissolves the silver and leaves the gold. When other metals besides silver are mixed with the ore, it is pounded, washed, and the gold afterwards separated by cupellation. When the proportion of gold to silver is much less than 1-4th, it is separated by heating the alloy with 1-8th part of sulphur, and when it has been fused for about three hours, it is poured into cones greased on the inside. As it cools, the gold sinks to the bottom, and a sulphuret of silver remains at the top. There are other processes for procuring gold, but being neither generally practised, nor of an interesting nature, we shall say nothing about them.

The chemical and mechanical properties of gold may be described in a few words:—Its colour is reddish-yellow, and in lustre it does not equal mercury, silver, steel, or platinum, though it is superior to all other metals. It is rather softer

than silver. It is so malleable that even when alloyed with copper, in the proportion of three grains to an ounce, it can be beat so thin, that gold-leaf is only 1-282,000th of an inch thick. It would be still more malleable without the copper; and when employed to gild silver wire, it is found by computation to be only 1-12th part as thick as gold-leaf. When viewed in this state with a microscope, it shows no cracks. An ounce of gold or silver wire is capable of being extended, according to the statement in Lewis's Philosophical Commerce, 1300 miles in length. In tenacity and strength gold comes after iron, copper, platinum, and silver. It requires a heat twice as great as mercury to melt it, and is so difficult of volatilization that for a long time it was regarded as perfectly fixed. It may be exposed for a long time to a great heat, and to air, without undergoing any alteration. Powerful burning-glasses, however, as well as flame urged on it by a stream of oxygen, have effected its volatilization. Electricity converts it into a purple oxide. Franklin, who first performed this curious experiment, found, when gold-leaf was placed between two thin plates of glass, leaving both ends hanging out, and an electrical shock was transmitted through it, that the gold-leaf disappeared in places, and the glass was tinged with purple. When gold is melted, it has a bluish-green colour, and the light transmitted through gold-leaf is of the same colour. It expands considerably when melted, and contracts on cooling, which makes it less fit for nice castings, such as statues, &c. The only acids which act on gold are *aqua regia*, or a mixture of muriatic and nitric acids, and muriatic acid mixed with chromic acid; aqueous chlorine also dissolves gold. Its alloys with silver or copper, to make coin, and with copper, to make trinkets, are well known; and it also unites readily with other metals, and forms alloys, of which little or no use has been made. When alloyed with bismuth it presents the remarkable fact of the gold becoming brittle by the addition of the smallest quantity of this metal. It is even said that gold is deprived of its ductility by merely keeping it, while fused, near bismuth raised to the same temperature. The purpose of alloying gold with silver and copper, as is the case in Britain, where the gold coin contains 1-12th of these less valuable metals, is to add to its hardness and durability. This alloy, it has been ascertained, suffers much less from friction than pure gold, and the stamp is not so liable to be obliterated. An alloy of gold and silver being more fusible than gold, is employed to solder pieces of it together.

Platina, or Platinum, for this name is written both ways, was first discovered to be a distinct metal about the year 1749. For a knowledge of it, therefore, and of its many valuable properties, we are indebted to the moderns, and chiefly, indeed, to our cotemporaries. Mr. Wood was, we believe, the first person to make it known, and since his time its nature has been investigated by several chemists. It was first found in Choco, in Peru, and in the mine of Santa Fe, near Carthagena; and it has lately been discovered in the silver mines of Guadalcanal, in the province of Estramadura, in Spain. It has also been found in the Brazils, and always in the same state of native platinum, and consisting of scales or grains. In 1814, a mass weighing 1lb. 9oz. 1drm., was picked up in Quebrada de Apoto, in the province of Notiva, government of Choco, in South America. This was considered so great a curiosity, that it was presented by its proprietor, Dr. Ignacio Hurtado, to the king of Spain, and it is now deposited in the Museum at Madrid. Platinum is not, therefore, very plentiful, and the ore which has been discovered is always accompanied by four other new metals, which we shall afterwards describe. It is brought from America in the same state as it is found, and is then very impure, containing several other metals.

To purify it the platinum is dissolved in nitro-muriatic acid, with as little heat as possible; the solution is poured off the undissolved matter, and the platinum is precipitated by muriate of ammonia. Wash the precipitate, and expose it to a heat raised slowly to redness. By redissolving it and repeating the process, you obtain pure platinum in grains; they are wrapped in a thin plate of the same substance, heated, and cautiously hammered till they are formed into an ingot.

Platinum, thus purified, is the heaviest body we are acquainted with. Its colour is the same as that of silver, but it is not so brilliant. It is harder than either gold, silver, or copper, but not so hard as iron. It is capable of being welded like iron, but is one of the most infusible of metals, and requires the strongest artificial heat we can produce to melt it. Exposure to air has no effect on it; and the only acid which attacks it is a mixture of one part nitric and three parts muriatic acids. In ductility and malleability it is perhaps inferior to gold, but superior to all other metals. Platinum unites with oxygen, and one of its oxides has been recommended by Mr. Cooper, as a valuable addition to the colours of enamellers, as it is not reduced when heated with enamellers' flux. Platinum forms alloys with the other metals, only one of which appears to have been put to any use, or to possess any interest. Tin, indeed, unites with platinum, showing considerable chemical action. If a piece of tin foil and platinum are wrapped up together, and exposed to the action of the blow-pipe, or a lighted candle, they combine immediately, and give out both light and heat. A very small quantity of platinum added to copper, renders it of a golden colour, makes it harder, of a finer grain, and not so liable to corrosion. An alloy of this description, with a little silver, is at present employed in the manufacture of Mr. Stansbury's patent locks, and contributes to their durability. Platinum is obtained in too small quantities, and is too difficult to work, to be put, at present, to many uses. Its valuable properties, uniting the indestructibility of gold with the hardness of iron, point it out, however, as well adapted to a variety of purposes. From resisting the action of heat, and the most concentrated acids, it is peculiarly useful when formed into some chemical instruments, such as crucibles, small tongs, rods, &c. On the other hand, it is speedily corroded by caustic alkalies, and even neutral salts, contained in minerals, have been known to injure platinum vessels. It has, indeed, been said, that a Mr. Strauss has discovered a mode of applying it, with as much ease as tin, to the inside of copper vessels, which, could it be effected, would be of considerable utility. Perhaps the most valuable use to which platinum has yet been put is to furnish a light to the miner, when any ordinary lamp would either be extinguished or subject him to an explosion. The moment the common light in the safety-lamp is extinguished by the superabundance of carburetted hydrogen gas, a coil of platinum wire, suspended over it, becomes red hot, and affords light enough for the men to find their way back from the threatened danger. When they return to where the air contains less than 1-4th of carburetted hydrogen, the lamp is rekindled by the wire. This property also has been taken advantage of to make an instantaneous fire machine, by exposing platinum to the action of a stream of hydrogen gas. The invention for this purpose, as well as the temperature at which the incandescence of the platinum wire takes place, have already been described in No. III. and No. XI. of the Chemist.

QUERIES.

To the Editor of the Chemist.

Mr. Editor,—Can you account for the following phenomenon, if it be such?

I put by a very strong solution of common salt, after purifying

it by carbonate of soda, as suggested by Dr. Henry, to crystallize, in an evaporating dish, which I placed on a shelf. After some days, I found partial and imperfect crystals on the outside of the dish, and that the place on which it rested was completely wet. I dried the place, and replaced the dish where it had been before. The same appearance of wet was, in a few days, renewed, and wiped away again. I then, instead of placing the dish containing the solution on the shelf, put another empty dish under it, smaller than the first, to prevent the bottom of the first dish from resting on the inside of the other; and in a few days I perceived some of the *solution* in the *under* dish; but, on a careful examination of the bottom and sides of the upper dish, I could not see any thing like the appearance of wet. Now,

Qu. 1. How did this portion of the solution escape from the upper to the lower dish? by capillary attraction, or how otherwise?

Qu. 2. How is it that no appearance of wet was visible on the outside of the upper dish?

An answer to these inquiries, if they deserve it, will oblige

A constant reader,

Chemicus Ignoramus.

July 2.

We thought there was something quite inexplicable in the foregoing circumstance, and requested to be informed if no fact had been omitted. The following additional letter came. We should still beg to ask our Correspondent, what distance the solution was below the edge of the dish, and if the pasteboard was wet?—Ed.

Sir,—I did state all the particulars which appeared to me to have an influence on the phenomenon I described. But it has since occurred to me, that I should have mentioned my *placing a card or piece of pasteboard loosely* over the dish containing the solution, though this does not suggest to me a sufficient account of the external crystallization. Not above one or two crystals formed on the under side of the card.

On one or two of the very warm days we have lately had, the outside of the dish containing the solution was wet, and even a large drop of it might be seen at the bottom of the dish ready to fall; but at other times (last night and this morning early, for instance,) nothing of the sort was visible, on the most careful examination of the outside and bottom of the dish. It is, therefore, I think, evident, that the appearances I have noticed are materially influenced by the different states of the atmosphere.

The crystallization on the outside is chiefly confined to those parts of the dish which have been most exposed to the light and air coming from the window, the opposite side of the dish, being near the wainscot of the light closet where I have kept it, having no crystals upon it.

The crystallization is thickest and most imperfect at the top, towards the rim or upper edge of the dish, where it is now quite in lumps in one or two places. Lower down the outsides, the crystallization, as far as it extends, is much more perfect. The crystallization on the inside is nearly all round, pretty equal, and much less thick than that on any part of the outside. There are a few separate perfect crystals (cubes) to be seen on the inside.

I have hitherto been speaking of the largest of the two dishes, and in which the solution was originally placed. There has been no appearance whatever of wet or crystallization on the outside of the smaller or under dish, on which I placed the larger one; nor is the portion of the solution in that dish considerable, perhaps 30 or 40 drops, and which shows no tendency to crystallize. It is as salt as the solution in the upper dish, for I tasted it; so that it is certainly not by mere evaporation that the liquid has escaped from its original situation, in which

case, I apprehend, the evaporated, and subsequently condensed, water would have been fresh as if distilled.

I remain, as before,

Chemicus Ignoramus.

July 13.

ANSWERS TO QUERIES.

To the Editor of the Chemist.

Mr. Editor,— Having observed some strange questions in your 17th Number, as to light, I take the liberty of sending you the following answers. In doing it, Sir, I must observe that we are all more ready to discuss those subjects which lie, perhaps, beyond the reach of man, than those open to his investigation. The fact is, that the fancy is at full liberty of exerting itself on all matters which cannot be brought to the test of experiment, and on such, therefore, we are all free to hazard conjectures, and give explanations, because we have no dread that any person acquainted with the subject can prove our conjectures erroneous, or our explanations absurd. Juvenis's question as to the sun being the primary or secondary source of light, seems of this nature; and, according to the principle just mentioned, I am ready to reply to it, while I have frequently passed by, thinking they might be answered by any body, several questions of a more useful nature. Perhaps, too, Juvenis's question carries an answer with it, when it is closely examined. The term *light*, Sir, means only the unknown *cause* of vision; it is not felt, it cannot be weighed, it has no extension, nor is *light* itself seen. Thus, therefore, to reply to Juvenis's third question, first, the *light* is proved, by our applying the same term to it, to be the same whether *emitted* during combustion, or proceeding from the sun. The term means only the unknown cause for perceptions of sight; and its effects, namely, these perceptions, being the same, we pronounce the cause to be the same.

To come now to Juvenis's second question: in ordinary language, *reflected* light is light proceeding from one body to another, and sent back from it. Does Juvenis know any body which sends *its* light to the sun? Till he or some other person discovers one, it must be admitted that *light* is *not* reflected from the sun. As to Juvenis's second question, whether heat proceeds or not from the same source, it is so difficult to answer, that I must leave it to some more acute Correspondent.

I am, Sir,

Your obedient servant,

B. B. G.

TO BLUE AND GILD STEEL.

Mr. Editor,—In answer to your Correspondent, A. R., No. XVIII., I beg leave to observe, that the mode employed in blueing steel is merely to subject it to heat. The dark blue is produced at a temperature of 600°; the full blue at 560°; and the bright blue at 550°. Your Correspondent has, therefore, only to subject the steel to the requisite degree of temperature. He may also gild steel by the following process:—To a solution of muriate of gold add nearly as much sulphuric ether; the ether reduces the gold to a metallic state and keeps it in solution, while the muriatic acid separates, deprived of its gold, and forming a distinct fluid. Put the steel to be gilded into the ether, which speedily evaporates, depositing a coat of gold on the metal by dint of the attraction between them. After the steel has been immersed it should be dipped into cold water, and the burnisher should be applied, which strengthens its adhesion. Figures, flowers, and all kinds of pretty ornaments and devices, may be drawn on the steel, by using the ether with a fine brush or pen.

I am, Sir,

Your obedient servant,

Richmond, July 13. Oraculus.

Fig. 1.

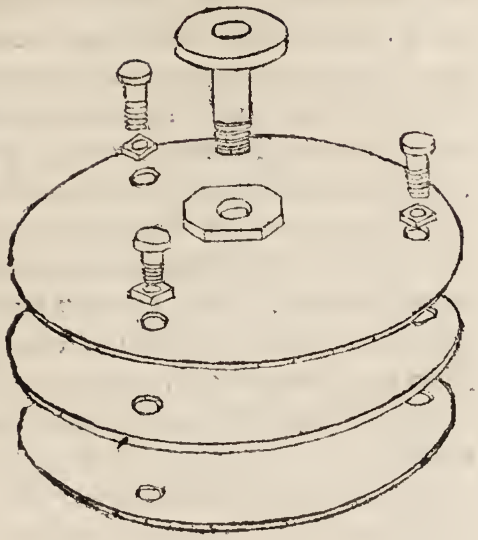


Fig. 2.

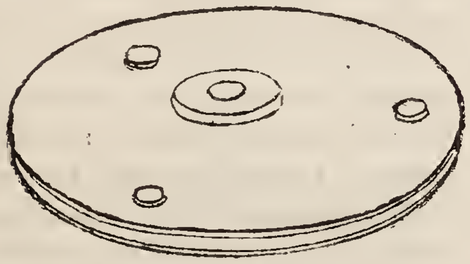
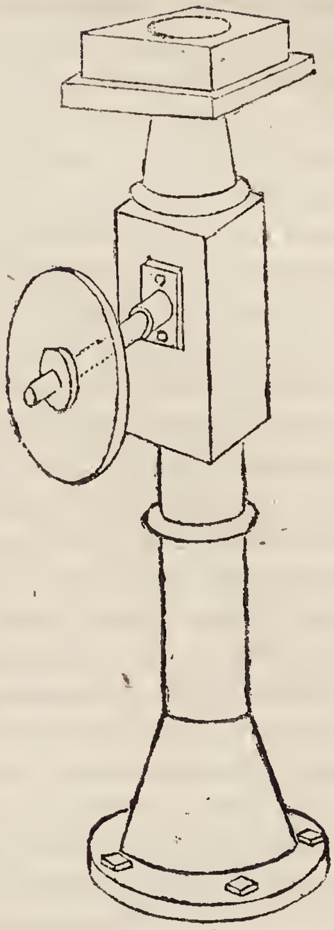


Fig. 3.



MR. BARLOW'S IMPROVEMENT IN THE MARINER'S COMPASS EXPLAINED.

(*Abridged from the Edinburgh Philosophical Journal.*)

We have already, in No. XV., mentioned the reward bestowed on Mr. Barlow for his valuable discovery, which seems to have given, for the first time, a sure and safe guide to the mariner over the pathless deeps. We now mean to explain more particularly, in what that discovery consists; and our motive for doing this is to spread, as far as we can, a knowledge that is likely to save the lives and property of many most valuable fellow-citizens. In a maritime country like ours, which, though so greatly indebted to its commerce for its prosperity, has not yet half profited by its admirable situation, the smallest details on maritime subjects should be interesting to the people. We shall not therefore, we trust, be censured for giving a place in our pages to an account of a discovery, which must have a considerable influence both on our prosperity and our power. It has been said, also, "that if any vessel be in future allowed to go to sea, especially in high latitudes, without the precautions pointed out by Mr. Barlow, the loss both of property and lives, in the event of shipwreck, may, in most cases, be fairly attributable to the owners." But those owners only can be held responsible who are acquainted with Mr. Barlow's discovery; and we may do something towards creating that responsibility. Mothers who have children, wives who have husbands, children who have fathers, and all who have relatives and friends at sea, must be interested in whatever contributes to their safety. Sailors are so habituated to danger, that they are proverbially careless, and even think it unmanly to take precautions. Those to whom they are dear must, therefore, do this for them, and enforce on them the necessity of adopting a landsman's discovery; because, not being so bold as they are, he has sought out the means of avoiding danger.

That they have allowed him to make this discovery is, in fact, a proof of their carelessness. For 600 years have they made use of the compass; day after day have they found its indications wrong, and been obliged to imagine strange currents in the ocean, or suppose an up hill and down hill at sea, to account for the ship's running ashore, or reaching spots from which, judging by their compass, they ought to have been far away. Notwithstanding frequent and enormous errors of this kind, causing a great loss of ships and valuable lives, so careless or so confiding have they been through all these 600 years, that, as far as we know, no one of them ever seems to have thought their compass was sometimes a faithless guide. In 1794, Mr. Downie, master of his majesty's ship Glory, was the first to remark, that the "quantity of iron in ships had an effect in attracting the needle." Capt. Flinders traced its connexion with the dip of the needle; but the matter was again forgotten, till Mr. Bain, another master of the navy, published, a few years ago, his valuable "Treatise on the Variations of the Compass." This fixed attention; and Captains Parry and Ross being directed by the Admiralty to make observations on the subject, during the voyage to the North Pole, it was found that the compasses were, on some occasions, upwards of 50°, or more than the eighth of a circle wrong. This effect was certainly not so great formerly as at present, owing to the greater quantity of iron now used in constructing and ballasting our ships. The great pitch, however, to which it has now arrived, called for a prompt and efficacious remedy, or there could be no security for sailors: Mr. Barlow set himself to this task and succeeded. We shall not follow this gentleman through his ingenious experiments and his mathematical demonstrations, but endeavour to give our readers a plain account of the cause of the incorrectness of the common compasses, and of his remedy.

It has been long known, that when a magnetized needle is freely suspended, it only preserves itself in a horizontal position in a small zone near the terrestrial equator. To the south of this the south end of the needle dips or inclines to the horizon; and to the north the north end dips or inclines. This is owing to the magnetic attraction of the earth. It has also been long known, that the *upper* ends of all iron bodies attract the north end of such a needle in northern, and the other end in southern latitudes; and the lower ends of all iron bodies have an opposite effect. It is *now* known too, from experience, that when the ship lies with her head and stern north and south, or in a line with the magnetic meridian, that these two attractions are either coincident or directly opposite, and have no effect on the lateral direction of the needle; but when the ship's head is turned towards the east or the west, the needle, owing to the effect of these two opposite forces, namely, the magnetic attraction of the earth and the attraction of the ends of the iron bodies in the ship, no longer points north and south, and its variation will depend on the resulting action of both the magnetic attraction of the earth and the iron of the ship. This variation, when not taken into account, as it never was till now, makes the course of the ship, as shown by the compass, different from her real course. It depends, too, on so many circumstances, such as difference of place, difference of direction of the ship's head, and the quantity and position of the iron in her frame, as almost to bid defiance to calculation. The first additional fact Mr. Barlow seems to have ascertained was, that the points in all bodies of iron, situated between their upper and lower ends, which had no effect on the needle, were all in the same plane, and this plane formed with the horizon an angle equal to the complement of the dip descending from the north towards the south. The needle of the mariner's compass is suspended horizontally, or

is not allowed to dip; and Mr. Barlow found that the same fact was true of such needles, as well as of dipping needles. It was before known, that a large mass of iron attracted more powerfully than a smaller mass, and that the power varied inversely as the cube of the distance; Mr. Barlow has, however, shown, which fact is very extraordinary, that this power resides wholly in the surface of the iron, and is the same in a hollow shell, the substance of which is not one-twentieth of an inch thick, as in a solid ball of the same circumference.

These discoveries were applied as follows:—It is plain, that in such a mass of iron as forms part of a ship, by far the greater part is neutralized by opposite actions, and that all the effect may be referred to one single point of the vessel; and this point, as regards the ship, will be the same in all parts of the world. But as the surface of iron only possesses magnetic power, it must be easy to procure a plate of iron of inconsiderable weight, which, when placed near the compass, shall counterbalance the iron of the ship. The first thing to be done is to ascertain the local attraction of each vessel. The ship being so moored as to admit of her head being directed to each point of the compass successively, and there steadied, the bearings of some distant object are to be taken round the whole circle. These bearings will vary from each other according to the attractive power of the vessel; and it will be found that two of them, taken while the ship's head was directed to opposite points of the compass, nearly agree. The mean of these two is considered the true bearing; and by them also the line of no attraction in the vessel, which is generally straight, fore and aft, is known. By then comparing the true bearing with the bearing found at every point of the compass, the local attraction at every one is found. Hitherto it has been a matter of experiment on shore, to determine the situation in which a plate of iron ought to be placed, as to the compass, in every ship, in order to correct the local attraction. Tables will ultimately be calculated, however, so as to make this unnecessary. The plate may be placed either before or abaft the compass; in the former case doubling the effect of the attraction, in the latter neutralizing it. The former is better for southern voyages, the latter for high northern latitudes. The plates vary from 12 to 16 inches in diameter, and, in fact, the instrument has hitherto been made of two plates screwed together. They have a hole in the centre, through which is passed a brass socket with a broad head, having an exterior screw, with which the two plates and an interposed piece of wood of the same size are strongly screwed together, the board being intended to increase the thickness without adding to the weight. The several parts of the plates are represented in Figs. 1 and 2, and Fig. 3 shows the brass pin, socket and pedestal, and the whole combined, as in action on ship-board. We have only to add, that this apparatus has been tried in several of his Majesty's ships with the greatest success. In one instance, reported by Lieutenant Mudge, the situation of the ship, after a run of 183 miles, as pointed out by the common compass, differed 19 miles in latitude, and 32 in longitude, from her true situation. On trying the compass by Mr. Barlow's corrected one, it was found to be wrong 7°; and when this correction was applied, the situation of the ship, as indicated by the compass, differed from her true situation only two miles of latitude, and four of longitude. We are quite sure that our readers, whether they are animated by patriotism, or soothed by the more gentle feelings of humanity, will forgive us for occupying so large a portion of our space with the description of a simple instrument, which, we conceive, will be to sailors what Sir Humphry Davy's safety-lamp is to miners. Before they possessed these, they could descend into the mine or sail over

the ocean; but now alone can they do either, with an instrument in their hand that warns them when danger is near, and shows them how to avoid it.

DICTIONARY OF CHEMISTRY.

Aubier, *alburnum.* The layer of wood in trees next the bark, so named to distinguish it from the more perfect wood, which is harder and browner.

Auripigmentum, *yellow orpiment.* A mixture of arsenic and sulphur.

Aurum Fulminans, *fulminating gold.*

Aurum Graphicum. An ore of tellurium.

Aurum Musivum, *musicum, mosaicum.* A combination of tin and sulphur, the proportions of which it is not necessary should be determinate. It is used as a pigment to give a gold colour to statues made of plaster of Paris, and also mixed with melted glass, to produce an imitation of lapis lazuli.

Aurum Paradoxicum. An ore of tellurium; all these ores contain a greater or less quantity of gold, and hence their name of *Aurum.*

Avanturine. A species of quartz rock, containing spangles of mica.

Axe-stone. A mineral, so named from being worked into hatchets by the New Zealanders. It is a species of jade, and is found in Corsica, Switzerland, and other parts of Europe, as well as in New Zealand.

Azotane, *chloride of azote.*

Azote, *nitrogen, corrupted air, mephitic air, phlogisticated air.* An elementary substance, forming about four-fifths of the atmosphere, and entering largely into the composition of all animal bodies.

———, Deutoxide of, *nitrous gas.*

———, Protoxide of, *gaseous oxide of azote.*

Azotic Gas. The gas of which azote is assumed to be the base.

Azotites, *nitrori.* The name given by some chemists to compounds of protoxide of azot with bases.

Azure-stone, *lapis lazuli.* A mineral of fine azure colour, from which ultramarine is prepared. The finest specimens are brought from China, Persia, and Great Bucharia.

Balance. In chemistry it is essential to have the weighing machine perfect, particularly as not a few important theories on the composition of bodies are formed from the weight of their component parts. For this purpose analytical chemists employ very delicate instruments. Ramsden lately made a balance for the Royal Society, which turns on steel edges placed on planes of polished crystal. It is said to be sensibly affected by the seven millionth part of the weight it is capable of weighing.

Balas Ruby, *spinelle.* A precious stone of red and blue, or brown colour.

Baldwin's Phosphorus. Ignited nitrate of lime.

Balloon. In chemistry, a receiver of a spherical form. In Aerostatics, a silken bag employed to contain air of a less specific gravity than the atmosphere, and consequently to rise from the surface of the earth.

Balm of Gilead, (not Dr. Solomon's) *opobalsum.* A balsam obtained from the *amyris Gileadensis,* a tree which grows in Arabia, particularly near Mecca. It is highly valued by the Turks, and seldom or never met with among Christians.

LUMINOUS PLANTS.

Potatoes kept in a cellar in a growing state sometimes become so luminous that we can read print by their light. The *dictamnus albus*—white dittany, spreads around it in dry summer evenings an atmosphere which, when a taper is brought to it, burns with a bright blue flame. Some plants give out a sparkling light, probably of the nature of electricity; such is the case with the flowers of calendula (marygold), tropœolum (Indian cress), lilium bulbiferum, and chalcedonicum (lilies), tagetes (French marygold), helianthus (sunflower),

and polyanthus. Others give out a calm, steady light, of a bluish, greenish, or yellowish-white colour, such as dematium violaceum, *Pers.* schistostega osmundacea, W. and M., philolaca decandra, rhizomorpha pinnata, *Humb.* The luminous appearances in the galleries and shafts of mines are often to be traced to rhizomorphous plants. The milky juice of some plants is very luminous, and when in a state of incipient decomposition, branches, trunks, and roots of trees become luminous.—*Edinburgh Philosophical Journal.*

EFFECTS OF SULPHURETTED HYDROGEN GAS.

To the Editor of the Chemist.

SIR,—In your last Number there is a very extraordinary account of a discovery, by M. Chaussier, of the fatal effects of sulphuretted hydrogen gas. What might be its effect on putting a cat's foot into it, I never had the curiosity to try, but that the least quantity of it in the air we breathe causes instant death, I positively deny. I once inhaled it as I was carrying on a process in which a considerable quantity is disengaged. It produced nothing more than fainting, and, as you now see, certainly did not terminate fatally. Either M. Chaussier has "*put his foot into it,*" or I have great reason to be thankful that I am not

July 12. A CAT'S-PAW.

Is our Correspondent quite sure that what he inhaled was sulphuretted hydrogen? No doubt has hitherto been thrown on the accuracy of M. Chaussier's statements, and he enjoys a considerable reputation. We should be glad, therefore, if our Correspondent would describe the process he alludes to, as the fact he states is of great importance.—ED.

TO PREPARE MURIATIC ACID.

ACIDUM MURIATICUM.

TAKE dried muriate of soda, two pounds; sulphuric acid, by weight, twenty ounces; distilled water a pint and a half. First mix the acid with half a pint of water in a glass retort, and to the mixture, when cold, add the muriate of soda; pour the remainder of the water into a receiver; then adapting the retort to it, let the muriatic acid distil into the water from a sand-bath, the heat being gradually raised till the retort becomes red hot. The specific gravity of muriatic acid is to that of distilled water as 1.160 to 1.000. One hundred and twenty-four grains of crystallized subcarbonate of soda are saturated by 100 grains of this acid.

Muriatic acid, when perfectly pure, is colourless; it emits white, suffocating fumes, which turn vegetable blues red; and its taste is very sour and acrid. As it is usually met with, however, it has a yellow tinge, which is owing either to the presence of chlorine or peroxide of iron; if the former, it may be determined by the smell, or by its power of dissolving gold leaf; the latter is detected by adding a solution of ammonia, which, when in excess, throws down a peroxide of iron, of a reddish-yellow colour. Sulphuric acid, which it sometimes contains, is discovered by adding a solution of muriate of barytes to a portion of the acid, diluted with four or five parts of distilled water. This dilution is necessary, because the acid, when concentrated, attracts the water from a solution of muriate of barytes, and causing it to crystallize, gives a fallacious appearance of the presence of sulphuric acid.—*Pharmacopœia Londinensis, Phillips's Trans.*

INODOROUS HYDROGEN GAS.

WHEN hydrogen gas, obtained from a mixture of iron filings and diluted sulphuric acid, is passed through pure alcohol, the gas nearly loses its odour, and if water be added to the alcohol, it becomes milky. If enclosed in a flask, and left for some days, an odorous vo-

latile oil is deposited, which was contained in the gas, and which contributed to its odour. Perfectly inodorous hydrogen gas may be obtained by putting an amalgam of potassium and mercury into pure distilled water; but if an acid or muriate of ammonia be added to the water, which accelerates the developement of the gas, it also acquires the same odour as that remarked in the solution of zinc in weak sulphuric acid. This odour, therefore, does not belong to the hydrogen gas, but is given to it by impurities.—*Berzelius.*

TO PROCURE JALAPINE.

To obtain this new poison, macerate powdered jalap for twelve or fourteen days in acetic acid; a tincture is obtained, filter it, saturate it with ammonia, and shake the mixture violently; a *sabulous* deposit will fall, and a few crystals be deposited on the sides of the vessel. Collect both, and wash them in distilled water; redissolve them in strong concentrated acetic acid, and reprecipitate by ammonia added in excess, and small white acicular crystals are thrown down, which are jalapine.

ADULTERATION OF MERCURY.

Mr. Editor,—As you have in a late Number described this substance and its uses, permit me to occupy a corner of your miscellany with a few remarks on its adulteration, and the means of detecting it. There is no substance, I can assure you, Sir, on very good authority, more subject to adulteration than mercury. It completely dissolves some of the less costly metals; they pass with it, as you described, through the pores of chamois leather, and they even rise along with it when distilled; they are, therefore, very frequently mixed with it in various proportions; and it is very remarkable, that the mercury will dissolve a greater quantity of lead or tin, if bismuth or zinc be previously added. This adulteration may be detected by the mercury not being so heavy as it ought to be, dragging a tail, as the workmen say, or by a small portion of it adhering to a flat piece of glass. It is of a duller colour, also, when adulterated; it tarnishes by long exposure to the air, and if shaken in a bottle with water, a black powder speedily forms. If lead be one of the impurities, it may be discovered by agitating the mercury with water, which oxidizes the lead. Pour off the water, and digest the mercury in acetic acid, which dissolves the oxide of lead, and its presence is proved by its forming a blackish precipitate with sulphuretted water. If only a very minute quantity of lead be present, it may be detected by dissolving in nitric acid; add sulphuretted water, when a dark brown precipitate will ensue, which in a few days will subside. One part of lead may in this manner be separated from upwards of 15,000 parts of mercury. Bismuth may be detected by a solution in nitric acid prepared without heat; pour it into water, when a precipitate will appear, if bismuth be present. The presence of tin is proved by adding a weak solution of nitro-muriate of gold, which throws down a purple precipitate. Trusting, Sir, that you may find a corner for these few remarks, I remain

Your obedient servant,

Purificator.

ACTION of ARSENIC on IRON.

To the Editor of the Chemist.

Sir,—Having seen the description of the phenomenon witnessed by Arsenicum in the 18th Number of the Chemist, I shall answer his three questions in the following manner:—

First, The injury sustained by the melting-pot is occasioned by the alloy acting on the iron by virtue of the great affinity of arsenic for iron.

Secondly, The action of the alloy on the vessel is confined to the edge of the melted compound only, because the iron of the cast iron being combined with carbon, its affinity is thereby lessened for the arsenic; but as the arsenic is oxydated on the surface, its oxygen

carries off the carbon in the state of carbonic acid, or gaseous oxide of carbon, leaving a portion of pure iron for the metallic arsenic to combine with. Here it is obvious that the arsenic being oxydated on the surface *only*, it is only at the edge of the alloy that the carbon of the cast iron can be carried off, and therefore it is there only that the iron is at liberty to combine with the metallic arsenic. I should not think that it was owing to any peculiarity in the cast iron.

I remain, Sir,
Your humble servant,
July 13. PROBLEMATICUS.

TO PURIFY PYROLIGNOUS ACID.

WHEN we described the mode of manufacturing this article, we did not state the purifying part of the process: we now mean to do this. In the distillation, the charcoal which remains is a product of considerable value; and it is found that this is better in proportion as the wood was dense; and that wood long exposed to the air gives more charcoal than green timber. This is a fact of some consequence in a practical point of view, as leading to the production of a better commodity, and in a theoretical point of view it seems to confirm the opinion of timber being strengthened and made durable by exposure to the atmosphere a certain time before being worked up.

When the acid is first obtained, it is found coloured of a reddish brown, from holding in solution a portion of the empyreumatic oil and tar that were formed at the same time with it; another portion of these ingredients is mechanically mixed with the acid. This latter is deposited by the acid, while it is in a state of rest, in the reservoir we have already described. A pump goes down to the bottom of this reservoir, and the tar, from its greater weight, sinking to the bottom, is occasionally pumped up. On the other hand, as the reservoir gets full, the clearest acid flows out from time to time into another reservoir. The acid thus separated from the tar, which was merely mechanically mixed with it, is pumped into large caldrons made of bricks or tiles, where it is saturated with either lime or chalk, as circumstances may direct. By employing the former, there is a danger of doing more than saturating the acid, and then the lime acts on the empyreumatic oil; by employing the latter, there is no danger of this, but it requires a greater degree of heat, and forms, from the various substances mixed with the chalk, a crust, which must be removed. Whichever is employed, the tar separates during the saturation, and is skimmed off. To the solution of acetate of lime thus obtained and concentrated by evaporation, is added a concentrated solution of sulphate of soda; sulphate of lime is precipitated, and acetate of soda remains dissolved. The liquid is allowed to remain some time at rest, when it is drawn off. The residuum is preserved for further use. The acetate of soda is then evaporated till it has obtained a sufficient degree of concentration, when it is placed in large vats or dishes, and in three or four days a number of crystals are formed, of rhomboidal shape and dark colour. The mother-water is drawn off, again concentrated, and again allowed to deposit crystals; and this process is repeated till it will deposit no more. The acetate of soda is afterwards dried or roasted for twenty-four hours—an operation which requires considerable care, and then it is dissolved in water, either as it comes hot from the stoves, which is, however, dangerous, or when it is cooled. In a state of solution, the carbonaceous matter which has formed is separated, and then the acetate of soda is obtained in the state of white crystals. This salt is then decomposed by sulphuric acid, and acetic acid obtained in a state of purity. The French writer whose very long account of this process we have endeavoured to give in a few words, adds, and very properly, that this branch of chemical manufacture is yet in its infancy, and

needs many improvements. As it is now, however, carried on to a considerable extent in several parts of Europe, there can be no doubt that it will be very rapidly improved. Perhaps, however, we may remark, that it is one of those manufactories which set in a striking point of view the utility of chemical science. Following its indications, the products derived from converting wood into charcoal, which were formerly dissipated in the air, are now condensed into a most valuable acid, just as the gas formerly dissipated from converting coal into coke now gives to our streets and houses a brilliant light, which has almost deprived villany of its power of concealment, and added to the security of society more than the most efficacious police regulations.

AN INSECT-DESTROYING WASH.

Mr. Braddick recommends the water through which coal gas is passed, as effectual for destroying the vermin on trees. He mixes one pound of flour of brimstone in three gallons of gas-water, and adds soft soap enough to make it adhere to the buds and branches when laid on with a painter's brush. The composition is not inflammable, and does no injury to the trees; and Mr. Braddick says he has proved this by the peach of China, the most delicate of all trees.—*Repertory of Arts, &c.*

FIRST CONGELATION OF MERCURY.

The fact of mercury becoming solid was first discovered by accident. A Professor Braun, at Petersburgh, in 1759, taking advantage of a very severe frost, plunged a thermometer in a mixture of snow and salt, to ascertain the degree of cold produced. Observing the mercury stationary after it was withdrawn, he broke the bulb of the thermometer, and found the metal frozen into a solid mass. Since then, mercury has frequently been frozen; and in this state, when touched, it affects the hand with a sensation similar to touching a piece of heated iron, the hand having the same appearance that it assumes when burnt.

TO CORRESPONDENTS.

T.C. is informed that, in The Chemist, No. III. p. 40, *we have given a receipt for what he inquires about; at the same time, there are so many methods recommended, that we will not answer for the one there described being the best.*

A Subscriber and Reader *had no occasion to offer us a* bribe, *as we have always a pleasure in obliging our Correspondents when it is in our power. His Letter, however, came too late to receive any answer this week, and in our next Number he will find what he asks.*

Our vivacious friend Anodyne, *who complains of our being dull, should attribute it not to us but to the* times. *Are not the newspapers dull? Are the magazines lively? Is not the world too busy to be cheerful? Are not all men so earnest in the pursuit of the means of enjoyment, that they forget to enjoy? Is there any thing novel, any thing brisk, spirit-stirring, or exciting in the world, except the horrid fanaticism in Ireland? and alas! this is any thing but cheerful. Is there even a good blazing fire or devastating flood to destroy half a city? It is the effect of skill, and of that increase in knowledge, which we labour to propagate, to prevent all kinds of* accidents, *and make the course of the moral world tend to regularity like the movements of the planets. Without surprise there is no very lively emotion; and thus, what our Correspondent complains of as dulness, in reality equanimity, in the passions of men, which, we say, is common to the rest of the world with ourselves, is the result of knowledge; and he, as well as every other intelligent man, is anxious to increase that which, in his sense of the word, is to render the world still more dull.*

*** *Communications (post paid) to be addressed to the Editor, at the Publishers'.*

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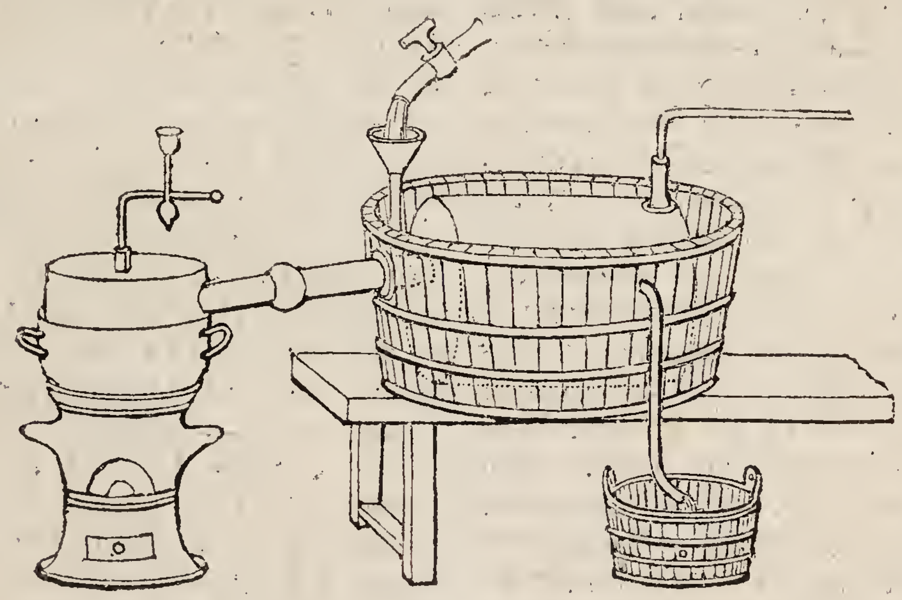
… The Chemist.

"—— Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if naught in these external scenes
Can move thy wonder?——"

No. XXI.] SATURDAY, JULY 31, 1824. [Price 3*d*.



CONTENTS.

PREPARATION OF SUBCARBONATE OF AMMONIA.

THIS salt is put to various uses, and is known under the name of volatile salts. Mr. Parkes says it is much used by bakers as a substitute for yeast. It is an excellent test for various substances, and is of great use to the chemist by its quality of dissolving some oxides, and by its great volatility, which allows it to be again easily separated. A great quantity of it is employed to give pungency to tobacco, and the odour of several perfumes is much increased in energy by the use of this salt. It is also frequently used for taking

spots out of cloth, and does not, like many other salts, produce, with the staining acid, if it be one, a more destructive spot than that which it removes. It is one of the products of all animal decomposition at an elevated temperature, but it is then always accompanied with a fetid oil, from which it cannot be easily separated, on account of its great volatility. To obtain it in purity, recourse must be had to some other ammoniacal salt. The following is the method usually employed:—Take eight parts of sal ammoniac,(muriate of ammonia) add to it ten parts of chalk which has been previously well washed and dried; mix them, and place them in either an earthen or cast metal retort, on a small furnace, as seen in the plate; with this, a receiver, made of lead, or a common jug with a hole at the bottom, having also at its upper part a socket for a handle, is connected by means of a tube passing from the furnace to the receiver. The latter is to be placed in a tub in which a stream of cold water can be made constantly to flow. The joinings are all carefully luted, and a plug which can be removed, at pleasure is put into the hole at the bottom. Heat is then applied, but very gradually at first, particularly if the retort is of earthenware. The best temperature is that which admits of the vapours being condensed as they are emitted; and the heat should always be lessened whenever, on moving the plug, vapour rapidly escapes. The operation goes on well when the vapour is not forcibly expelled, and a light cloud is seen in the receiver. As the operation goes on, the heat must be increased, and it is time to cease it when the vapour is forcibly expelled, and is no longer cloudy. The vapour of water then passes, and the operation should be stopped. The apparatus is allowed to cool, and the receiver, if of earthenware, is broken, and the upper part is found covered with the carbonate of ammonia, in white and dry crystals.

CHEMISTRY AS A SCIENCE.
Art. XX.

PALLADIUM. RHODIUM. IRIDIUM.

These three metals were all discovered in the years 1803 and 1804, and have never been found except in the ores of platinum. As they form but a small proportion of these, and these are not very abundant, the reader may be quite sure the three metals are not plentiful. They appear only to have been obtained in sufficient quantities to make experiments on, and ascertain their nature, and have been put to no use whatever. We shall therefore dispatch them in a few words:—Palladium was discovered by Dr. Wollaston, in 1803. It may be obtained by adding to a solution of crude platina in nitro-muriatic acid, prussiate of mercury, on which a precipitate generally takes place of a yellowish white colour. This is prussiate of palladium, and the acid may be expelled by heat, leaving the metal in a state of purity. It is white, resembling platinum. It is rather harder than wrought iron, and is very malleable. A very violent heat is required to fuse it, and it is not altered by exposure to the air. It forms alloys with the other metals, but they have been put to no use, and their properties have scarcely been investigated.

Rhodium was discovered a year later than palladium, by the same chemist. Crude platinum is to be freed from mercury by a red heat, and from other substances by digesting it in a sand heat with a small quantity of nitro-muriatic acid till the whole is dissolved except a quantity of black sand from which the solution is separated. Into the solution, sal ammoniac, dissolved in hot water, is poured, which separates the platinum in the form of a yellow powder. Zinc is immersed in the solution and allowed to remain as long as any precipitate is thrown down, which is treated with dilute nitric acid, in a gentle heat, to dissolve the copper and lead it contains. It is then dissolved in dilute nitro-muriatic acid, by the assistance of heat,

and common salt is added to the solution. This being evaporated to dryness, and the residuum washed with alcohol till it comes off colourless, there remains behind an oxide of rhodium, mixed with common salt. Dissolved in water, crystals are obtained by evaporation, which being again dissolved in water, and a plate of zinc immersed in the solution, a black powder precipitates. Heated with borax, this becomes white, and assumes a metallic lustre. This is rhodium; and not more than the 250th part is found in the ores of platinum. It is of a white colour, nearly resembling platinum. It is brittle, comparatively infusible, and in hardness equal to iron. It is insoluble in acids; and it forms oxides and alloys. It differs from platinum in the colour which it imparts to gold: a very small quantity of platinum is sufficient to alter the colour of gold so as scarcely to be distinguished from platinum, while the same quantity of rhodium has little or no effect on the gold.

Iridium was discovered about the same period, 1803, by Mr. Smithson Tennant, in England, and by M. Descotils in France. When crude platina is dissolved in dilute nitro-muriatic acid by a small degree of heat, there remains undissolved a quantity of black shining powder, formerly supposed to be black lead. It consists, however, of two distinct metals, one of which Mr. Tennant called *iridium*, from the variety of colours its solutions exhibit, and the other *osmium*, from the peculiar smell of its oxides. To separate the two from each other, heat the black powder to redness, in a silver crucible, with its own weight of potash, and keep it in that state for some time. Then dissolve the potash by water, and a solution is obtained of a deep orange colour. Digest the powder that remains in muriatic acid, which becomes first blue, then olive green, and, lastly, deep red. The powder which is undissolved, is to be treated alternately with muriatic acid and potash, till the whole is dissolved; and then two solutions are obtained; the alkaline of a deep orange colour, consisting chiefly of potash united to the oxide of *osmium*, and the acid solution of a deep red, consisting chiefly of muriatic acid united to the oxide of iridium. By evaporating the last to dryness, dissolving again in water, and again evaporating, crystals of muriatic acid, united with the oxide, are obtained. Being dissolved in water, a plate of any metal, except gold and platinum, precipitates the metal in the form of a black powder, which, on being heated, becomes white, and of a metallic lustre. It has the appearance of platinum, and resists the action of heat and air like that metal. It is said to be even heavier than platinum, but this is a point not so well ascertained. It resists the action of the most powerful acids, and, like the other metals we have just mentioned, could it be obtained in sufficient quantities, would be well adapted for several chemical purposes. It possesses also, like them, the properties of uniting with oxygen, and forming alloys with other metals; but neither the oxides nor the alloys have been investigated. In fact, the metal is procured in such very minute quantities, and by such a tedious process, that hardly any thing is known of it; and unless some more plentiful means of obtaining it should be discovered, it will never reward the researches of the chemist, and never be put to any use. The metals next in succession are of a character so different from these, that we shall not mingle a description of both in the same article, and shall reserve *Antimony* for the next Number.

CIRCULATION OF THE SAP IN PLANTS.

Dr. Schultz, of Berlin, has lately examined the leaves of the *Chelidonium Magus*, in order to ascertain as near as possible the mode in which the sap circulates in plants. The following he states as the result. There is at first an ascending motion, then a sort of trembling in

the currents. The first of these motions may be easily perceived, by bending the leaf of the *chelidonium*, still in the ground, or taking it out with its root, so that it may not be injured. He reflected a ray of light by a mirror to that part of the under side of the leaf which he desired to examine, and then observing the upper part with a microscope, soon saw a yellow trembling fluid flowing rapidly through little branches of transparent vessels with which the green substance of the leaf was nearly covered. The bundles of transparent vessels are composed of distinct tubes, and where they intersected each other, the velocity and progress of the fluid was most easily seen. Some of them come from the upper part of the leaf to the lower, while others go from the lower to the upper. The currents were sometimes intermitted and irregular, but the author did not discover regular periodical pulsations. The action is checked as the leaves begin to fade; and stops first in the small vessels, and, at length, in the large ones. Dr. Schultz observed, that the motion lasted much longer in the leaves of the calyx than in other parts, and there was always both an ascending and a descending current, though the latter stopped much sooner than the former. The author remarked a great analogy between the structure of the vessels of the leaves of the calyx and of the vessels of animals. The two contrary currents are no where better seen than in the branches; and of them, those which are yet soft and full of sap are the best. According to the opinion of Dr. Schultz, the ascending vessels become descending ones after reaching the extremities of the branches; there they mingle and *anastomose*, so that it would appear, the points of union of all the circulating vessels are in the extremities, or in the leaves; while in animals the blood flows to and from the heart as the common parent and reservoir. In plants, therefore, the life may be said to exist independent in every part, which may, perhaps, explain many of the familiar operations of grafting.

DICTIONARY OF CHEMISTRY.

Balsams. Vegetable juices, both liquid and solid. Their characteristics are, to be insoluble in water, but soluble in alcohol or ether.

Balsam of Sulphur. A solution of sulphur in volatile oil.

Balneum Regale. A name given by the alchymists to antimony, under the idea that the quantity of gold might be increased by alloying it with antimony.

Barbadoes Tar. A species of naphtha.

Barilla, *common soda, carbonate of soda.* The name which the soda of commerce has in Spain.

Barium. The supposed metallic basis of the earth barytes.

———, Chloride of, has been called *muriate of barytes.*

Barolite. A carbonate of barytes.

Baroselenite. A *sulphate of barytes.*

Barote. The name which Morveau gave to *barytes.*

Barras, *galipot.* The resinous incrustation about wounds made in fir-trees has received this name.

Barytes, *barote.* An earth, being an oxide of barium.

————, Muriate of, *chloride of barium.*

————, Sulphate of. Ponderous spar. *Terra ponderosa, bolognian stone.*

———— Water. Water holding barytes in solution.

Basalt. The mineral of which the Giant's Causeway in Ireland, and numerous other assemblages of natural columns, is composed.

Base, *basis.* All alkalies, earths, and metallic oxides, in relation to acids, with which they form *salts*, are called *bases.* It is also applied to what is supposed to be the determining element in acids and oxides.

Bassorine. A substance extracted from some gum resins, by treating them with water, alcohol, and ether.

BATH, in chemistry, signifies any means, such as heated sand, steam, or boiling water, of applying an equal degree of heat to substances. They are immersed in the sand, steam, or water, and the temperature of the latter is sometimes raised beyond the ordinary boiling point for particular purposes, by dissolving various salts in it. Water saturated with muriate of lime may be heated up to 250 Fahr.

BDELLIUM. A gum resin, of African origin, not unlike myrrh.

BEAN is only included in chemical dictionaries from having been, like many other vegetable substances, analyzed, and found to contain, volatile matter, starch, albumen, extractive gummy matter, and earthy phosphates.

BEE. Of this insect the same remark may in part be made; its poison has been found to resemble that of the viper.

BEER is a true chemical product, being the result of a chemical process. It has been, not inappropriately, called the wine of grain.

BELL METAL. An alloy of copper and tin with lead, zinc, or arsenic.

BEN, OIL OF, obtained from the ben-nut, by pressure.

BENZOATES. Salts formed with benzoic acid and a base.

BENZOIC ACID. Flowers of benzoin; a peculiar acid, obtained from the *styrax benzoe*, a tree which grows in Sumatra. It is a compound of hydrogen, carbon, and oxygen, and is used by perfumers, and as a cosmetic.

QUERY.

To the Editor of the Chemist.

Leeds, July 22.

SIR,—Will any of your Correspondents be kind enough to inform me what is the best method of preparing nitric acid for the dyer's use, or what is termed the nitrio-muriate; and the cheapest method of setting about the necessary erections fit for drawing acids used by dyers of woollen goods.

Your constant reader,

ALPHA.

ANSWER TO QUERY. TO PURIFY WATER CONTAINING IRON.

MR. EDITOR,—Having observed in the Chemist, No. XVI., that your Correspondent A. B. D——y wishes to be informed of a method to purify water containing iron, I request, if it meets your approbation, that you will insert the following reply to him. What he asks for has long been desired by other people, for water containing iron is of no use, or rather, is mischievous if used by bleachers, dyers, and calico printers; and as a great deal of water contains iron, it has long been a desideratum with those manufacturers to find out a cheap and expeditious method of getting rid of the iron. The metal is always held in solution by some acid; most generally it is either the sulphuric or the carbonic acid. In either case, the water gives, with a small addition of tincture of nutgalls, a purple or black colour; and if the solvent be sulphuric acid, the same test gives the same colour after the water has been boiled as before; while, if the solvent is carbonic acid, the test gives no colour after the water has been boiled. Having ascertained the solvent by these means, if it be sulphuric acid, by adding a small quantity of a solution of barytes the earth will seize the sulphuric acid, and precipitate it, while the iron, losing its solvent, will also be deposited. After this operation has been performed, if the water be allowed to remain at rest for a few hours, it will be fit for use. Great care must, however, be taken not to add more of the barytic solution than is necessary to combine with the sulphuric acid, as this substance is of a poisonous nature, and might be more injurious than the iron However, by allowing the water to remain exposed to the air, the carbonic acid of the atmosphere, or that of the water itself, will combine with the barytes, and precipitate it. When the acid is the carbonic, a little fresh burnt lime will separate the iron; but no more of this should be added

than is necessary, as this, too, is noxious. If more be added, exposure to the atmosphere will also precipitate it; but if there is not a sufficient time for this, the addition of a small quantity of sulphuric acid will precipitate the lime in 24 hours, when, if filtered, it will be fit for any purpose, either of manufacture or of domestic economy. Recommending your Correspondent first to try the above methods on a small scale, if he has any large quantity of water which he wishes to purify,

I remain, Sir,
Your obedient servant,
AQUA VITÆ.

CURIOUS DISEASE IN POLAND.

CRACOW may be considered the centre of that singular and revolting disease the *weichselzopf*, or *plica polonica*. It derives its name from the most prominent symptom, the entangling of the hair into a confused mass. It is generally preceded by violent head-ache and tingling in the ears; it attacks the bones and joints, and even the nails of the toes and fingers, which split longitudinally. I saw such furrows in the nails of a person twelve years after his complete cure. If so obstinate as to defy treatment, it ends in blindness, deafness, or in the most melancholy distortions of the limbs, and sometimes in all those miseries together. The most extraordinary part of the disease is its action on the hair. The individual hairs begin to swell at the root, and to exude a fat slimy substance, frequently mixed with suppurated matter, which is the most noisome feature in the malady; their growth is at the same time more rapid, and their sensibility greater than in the healthy state; and notwithstanding the incredulity with which it was long received, it is now no longer doubtful, that where the disease has reached a high degree of malignity, not only whole masses of the hair, but even single hairs, will bleed if cut off, and that too throughout their whole length as well as at the root. The hairs growing rapidly amidst this corrupted mass, twist themselves together inextricably, and at last are plaited with a confused, clotted, disgusting looking mass. Very frequently they twist themselves into a number of separate masses like ropes; and there is an instance of such a *zopfe* (tail) growing to the length of 14 feet on a lady's head before it could be safely cut off. Sometimes it assumes other forms, which medical writers have distinguished by specific names: such as, the bird's-nest plica, the turban plica, the Medusa-head plica, the long-tailed plica, the club-shaped plica, &c.

The hair, however, while thus suffering itself, seems to do so merely from contributing to the cure of the disease, by being the channel through which the corrupted matter is carried off from the body. From the moment that the hair begins to entangle itself the preceding symptoms always diminish, and frequently disappear entirely, and the patient is comparatively well, except that he must submit to the inconvenience of bearing about with him this disgusting head-piece. Accordingly, where there is reason to suspect that a *weichselzopf* is forming itself, medical means are commonly used to further its outbreaking on the head; and among the peasants, the same object is pursued by increased filth and carelessness, and even by soaking the hair with oil or rancid butter. After the hair has continued to grow thus tangled and noisome for a period, which is in no case fixed, it gradually becomes dry, healthy hairs begin to grow up under the plica, and at last "push it from its stool." In the process of suppuration, however, it unites itself so readily with the new hairs, that if not cut off at this stage it continues hanging for years, an entirely foreign appendage to the head. There are many instances of Poles, who, suffering under ailments, the forerunners of an approaching *weichselzopf*, have in vain sought aid in other countries from

foreign physicians, and on their return have found a speedy though very disagreeable cure in the breaking out of the plica.

But till the plica has run through all its stages, and has begun of itself to decay, any attempt to cut the hair is attended with the utmost danger to the life of the patient. It not only affects the body, by bringing on convulsions, cramps, distortions of the limbs, and frequently death, but the imprudence has often had madness for its result; and, in fact, during the whole progress of the disease, the mind is in general affected no less than the body. Yet, for a long time, to cut off the hair was the first step taken on the approach of the disease. People were naturally anxious to get rid of its most disgusting symptom; and they ascribed the melancholy effects which uniformly followed, not to the removal of the hair, but merely to the internal malady, upon which this removal had no influence; medical men had not then learned that this was the natural outlet of the disorder. Even towards the end of the last century, some medical writers of Germany still maintained that the hair should be instantly cut; but the examples in which blindness, distortion, death, or insanity have been the immediate consequence of the operation, are much too numerous to allow their theoretical opinion to have any weight. The only cure known, is to allow the hair to grow till it begins to rise pure and healthy from the skin, which indicates that the malady is over; it is then shaved off, and the cure is generally complete, although there are cases in which the disease has been known to return. The length of time during which the head continues in this state of corruption, depends entirely on the degree of malignity in the disease.

Two instances of the wonderful disposition of the hairs thus to intertwist themselves with each other were mentioned to me, which I would not have believed had I not received them from an eyewitness, and would not repeat were not that eyewitness among the most respectable citizens of Cracow in character and rank, the historian of its fate, and a member of its senate. The first occurred in his own house. A servant was attacked with the weichselzopf; at length his hair began to rise in a healthy state from the head; it was shaved off, and the man wore a wig. But the cure had not been complete; the malady speedily returned, and the new springing hairs already diseased, instead of plaiting themselves with one another, made their way through the lining of the wig, and intertwisted themselves so strongly with its hair that it could not be removed until the the natural hair itself, from the extremity of which it depended, had returned to its natural state. The other case was that of a young lady, whose relations had cut off her hair at the commencement of the disease; the consequences were violent, and threatened to be mortal. Fortunately, the lady, with the liking which every girl has for a head of beautiful hair, had ordered her ravished locks to be preserved, and it was resolved to try an experiment. The hair was again bandaged on the head; as the new and corrupted hair sprang up, it united itself so firmly with it, that they formed but one mass; the convulsions and distortions disappeared, and in due time the cure was complete.

The weichselzopf, at once a painful, a dangerous, and disgusting disease, is not confined to the human species; it attacks horses, particularly in the hair of the mane, dogs, oxen, and even wolves and foxes. Although more common among the poorer classes, it is not peculiar to them, for it spares neither rank, nor age, nor sex. Women, however, are said to be less exposed to it than men, and fair hair less than brown or black hair. It is contagious, and may, moreover, become hereditary. In Cracow there is a family, the father of which had the *weichselzopf*, but seemed to be thoroughly cured; he married shortly afterwards, and his wife was speedily

subjected to the same frightful visitation, and of three children whom she bore to him, every one has inherited the disease. Among professional persons, great diversity of opinion prevails regarding its origin and nature. The more ignorant classes of the people believe that it is a preservation against all other diseases, and therefore *adorn* themselves with an inoculated *weickselzopf*.—*A Tour in Germany*.

SPINNING UNNECESSARY.

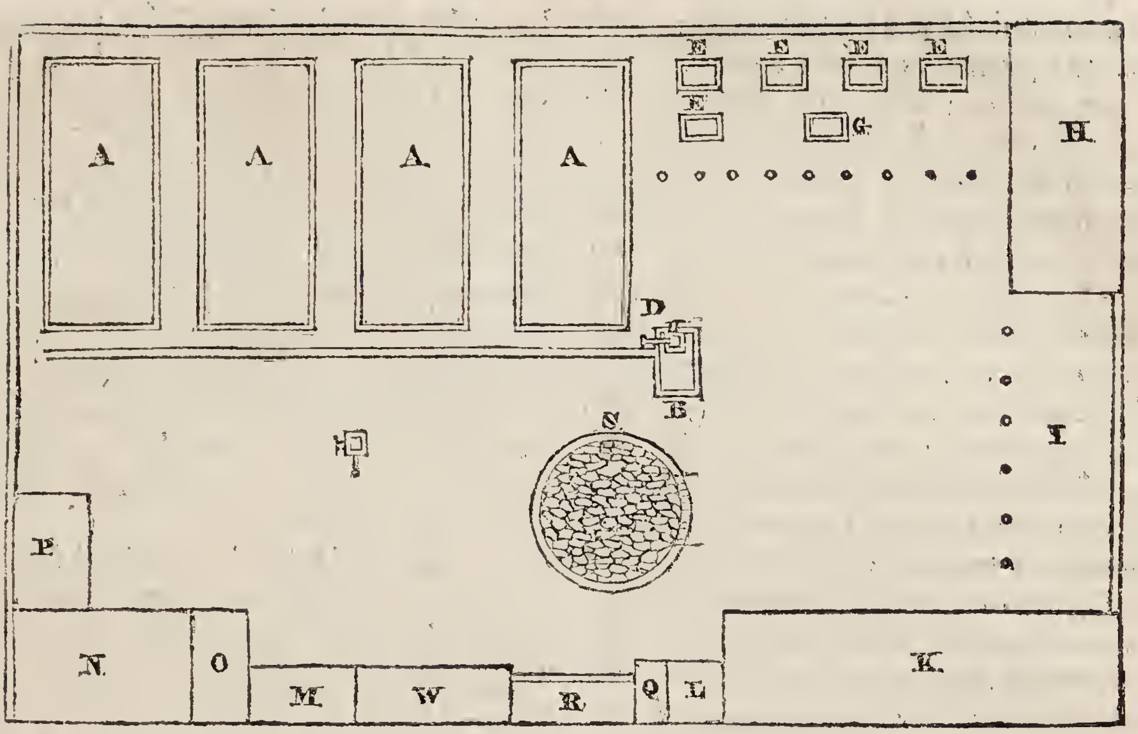
"Lieut. Herenstreit has invented a process, by which he makes a species of caterpillar spin a kind of wadding, which is of a fine white colour, and water-proof. He made a balloon of this stuff, and raised it by means of a chafing-dish, with spirits of wine, in the large warehouse where he keeps his caterpillars at work. He makes them trace ciphers and figures in the wadding, He accomplishes this by moistening outlines of figures or letters with spirits of wine. The caterpillars avoid these tracings, and spin their web around them. Thus, any figure which has been drawn is represented in the stuff. A piece of wadding seven feet square, perfectly clean, and as brilliant as taffeta, was made by about 50 caterpillars, between the 5th and 26th of June." This invention is said to have been made at Munich, the capital of Bavaria; and all persons must wish it should succeed, as it will convert a noxious insect into an intelligent cloth manufacturer.

MODE OF PREPARING ULTRAMARINE.

The stones called *lapis lazuli* are made red hot and thrown into the water, to make them pulverize easily; they are then reduced to a fine powder, and intimately combined with a varnish formed of resin, wax, and boiled linseed oil. It is then of the consistence of paste, and is put into a linen cloth and repeatedly kneaded with hot water. The first water is thrown away, the second gives a blue of the first quality, and the third yields one of less value. This process is founded on the property of the earthy matter of the stone adhering more firmly to the resin than the colouring matter, which is by this means extracted.

CHALYBEATE CURRANT WINE.

We have no doubt all our readers remember the story told by Sancho Panza of the excellent judgment given by two of his ancestors as to wine; but in case they should not, we will repeat it, as far as our memory serves us. These two great uncles of Sancho's were the two greatest topers of the village, and were called on, like some toad-eaters of the present day, to give their opinion of some wine which had just been broached, most probably by the priest, for that class of men generally, in those days, *broached* the oftenest and had the best. One of the judges, after taking a second hearty draught, for no liquid ever tastes well with one, smacked his lips, and declared it excellent, only it had a small twang of leather. This excited a smile in the owner of the wine, which was increased considerably, when Sancho's other uncle, having gone through the like process, also pronounced it excellent, but with a twang of iron. The company positively laughed; "but who," says Sancho, were triumphant, when it was found, on emptying the cask, that there was lying at the bottom a leather loop, having a rusty iron nail driven through one end?" Our recollection of this anecdote has been revived by observing, in the last Number of the Philosophical Magazine, an analysis of Mr. Harley's black currant wine, which was found to contain 20 grains of iron in each pint, being more iron than is contained in the steel wine of the Pharmacopœia. Did Mr. Harley look after the rusty nails? We are afraid not; if he had, both he and his scientific friend, Mr. Cufande Davie, might probably have found some rational cause for their black currant wine being a good chalybeate.



MANUFACTURE OF SULPHURIC ACID.

(ENGLISH METHOD.)

SULPHURIC aeid is a compound of the two simple substances oxygen and sulphur, in the proportion, by weight, of three oxygen and two sulphur. As it is usually met with in commerce, it is in a liquid form, which is owing to the water combined with it, and for which it has a very strong affinity. At Nordhausen, in Germany, a very much concentrated sulphuric acid is obtained from the distillation of green vitriol, and if this, put into a glass retort, be distilled by a moderate heat, and received into a vessel surrounded by ice, sulphuric aeid is obtained in a solid state. It is tough, and resembles asbestos in its appearance. When exposed to the air it fumes, and gradually flies off in vapour. In the solid state its properties are not known, and it is put to no use; but when united with water, in various proportions, it is perhaps the most useful of all the agents employed by the chemist, and more used in the arts and manufactories than any other aeid except the acetic. We propose, therefore, in the present paper to give a short account of the mode of manufacturing it on a large scale, as now carried on in various parts of France and England.

The diluted sulphuric acid, or the hydrate of sulphuric acid, as it is called, has been known since the latter end of the sixteenth century, and up to the early part of the 18th it was wholly obtained from sulphate of iron, or the green vitriol of commerce; and hence sulphuric acid was improperly called oil of vitriol. Dr. Ward then introduced the method of obtaining it by burning sulphur and nitre; and enjoyed the monopoly of this manufacture for several years. In 1746, Dr. Roebuck, an eminent and scientific physician, began at Birmingham the practice of burning the sulphur, and receiving the product in leaden chambers. That reduced the price of the article one-fourth, and allowed it to be employed for a variety of purposes from which it was before excluded by its great cost. Since that time manufactories of sulphuric acid on this principle have been established, on an extensive scale, in several parts of the kingdom.

In England it has not yet been settled what dimensions are the best for the leaden chambers; the manufacturers construct them according to their convenience; and Mr. Parkes*(whose account we are now abridging,) mentions one in Lancashire, who built several rooms 120 by 40 feet, and 20 feet high. Whatever may be the size of the chambers, the process is conducted in the following manner:—Common brimstone, coursely ground, is mix-

* "Chemical Essays," vol. I. p. 484.

ed with saltpetre in the proportion of eight pounds of the former to one of the latter; and the mixture is spread on leaden or iron plates, placed on stands of lead within a chamber wholly lined with lead and covered at the bottom with a thin sheet of water. About one pound of the mixture is allowed to every three hundred cubical feet of atmospherical air contained in each chamber; and when a charge in this proportion has been placed in one of them, the mixture is lighted by means of a hot iron, and the door is closed. The combustion of the two substances, if well mixed, continues about forty minutes. In about three hours the gas is all condensed, and the chamber is thrown open to admit atmospheric air, and prepare it for another burning. The plates are again charged, and the same process is repeated every four hours, without intermission either by day or night, until the water at the bottom of the chamber is thought to be sufficiently acidified. This is judged of by the acid turning black, when it is drawn off by means of a syphon into a reservoir of lead It is then concentrated by the action of heat in leaden boilers, until it has acquired such a specific gravity as best suits the manufacturer's purpose. It is afterwards boiled in glass retorts till all the sulphurous and nitric acids are driven off, and it is fit for the market. The necessity for the concentration by means of heat, arises from the water, after it has taken up a certain quantity, refusing to absorb the acid so readily as at first. Care, too, must be taken when the acid is in the leaden boiler that it be not too much concentrated, for the boiling point of much concentrated acid, and the melting point of lead are so near to each other, that the leaden boiler may be destroyed. Some manufacturers remove it at once into the glass retorts, and do not steam it in lead, which prevents the acid combining with so large a quantity of this metal. Lately, too, platinum alembics, placed within pots of cast iron of a corresponding shape and capacity, have been substituted for the glass retorts, and have been found to save fuel and quicken the progress of concentration. Mr. Parkes mentions that he had a platinum vessel constructed for rectifying sulphuric acid some years ago: it cost some hundred pounds, but answered the purpose perfectly well. The sulphuric acid of commerce always contains sulphate of potash, derived from the nitre, and sulphate of lead derived from the lead used in the process.

In order that this method should succeed, it is essential that oxygen be present to maintain the combustion, that the chamber do not allow the volatile matter which arises to escape, and that water be present to absorb it. For a long time, however, the *rationale* of this method was involved in doubt and obscurity. It was found that 100 parts of nitre, containing only 39½ of oxygen, when combined with the requisite quantity of sulphur, produces a quantity of sulphuric acid, containing 1200 parts of oxygen. Moreover, after the combustion of the sulphur, the residuary salts contain nearly as much oxygen as was originally contained in the nitre; and the 1200 parts of oxygen in the acid could not be accounted for. At length Messrs. Clement and Desormes, two manufacturing French chemists, succeeded in explaining this circumstance, and their explanation has since been confirmed by Mr. Dalton and Sir H. Davy. They supposed that the burning sulphur, taking from the nitre a portion of its oxygen, forms sulphuric acid, which, uniting with the base of the nitre, or potash, displaces nitric and nitrous acids in vapour, which is decomposed by the sulphurous gas into nitrous gas or deutoxide of azote. Being naturally only a little heavier than air, and being then rarefied by the heat, the nitrous gas rises to the roof of the chamber, and there coming into contact with atmospherical air, by means of a hole, and without which the manufacturers found that the acidification would not go on, forms nitrous acid

vapour, which, being a heavy body, immediately precipitates on the sulphurous flames. Sulphuric acid and nitrous gas are again formed, and the latter again mounts for a new charge of oxygen, again to re-descend and transfer it to the sulphur. Sir H. Davy has since shown that water is necessary to the mutual action of sulphurous gas, and nitrous gas, and that unless this fluid be present the process does not go on. With this additional fact it would appear that a small volume of nitrous vapour, by its alternate and frequent changes into oxide and acid, is capable of acidifying a great quantity of sulphur. We shall now describe the plate, which may serve to give our readers some idea of a sulphuric acid manufactory. We have borrowed it from the valuable work of Mr. Parkes, entitled "Chemical Essays."

It is the representation of the yard of a sulphuric acid manufactory, walled round with all its requisite buildings: AAAA are chambers of combustion made with sheet lead; B, the main reservoir, also of lead, to contain the acid drawn from the chambers; C, a trough lined with lead, to convey the acid to the reservoir. The acid is drawn by a syphon from the chamber into the trough; D, a pump to supply the leaden boilers, EEEEE, with acid from the reservoir. These boilers are for concentrating the acid. They are placed under a roof supported by pillars at the dots, marked F. G, the reservoir for the concentrated acid, provided with a close cover to prevent the acid absorbing moisture; H is the room where the acid is still further concentrated by boiling in glass retorts; I, is an open shed, supported on pillars, for packing, &c.; K, a warehouse; L, counting rooms; MN, store rooms; O, pounding room; P, stable; Q, small laboratory; R, entrance; S, coal store; T, pump for supplying water; U, another pump; W, a large storehouse.

(*French Method in our next.*)

ON RESPIRATION, AND THE PRODUCTION OF ANIMAL HEAT.

In our 19th Number we published a little article, showing the effect of evaporation in preserving bodies, animals as well as others, at about blood heat, when every thing around them is at a much higher temperature. This is a chemical phenomenon; for every thing relative to the production of heat falls into the department of chemistry. Admitting that evaporation is sufficient for this when the body is in a medium considerably hotter than itself, the question occurs, What is it which preserves the human body and other animals at a high temperature when they exist in a much colder medium? Is this, too, a chemical phenomenon? We believe it is; but many of our readers may perhaps be disposed to doubt the fact. They constantly experience sensations of heat and cold, in every part of their body, and may therefore not exactly comprehend what we mean, or doubt our assertion. We do not at present allude to what they feel, but to the state of the thermometer when brought into contact with the human body. We beg them, therefore, for the moment, to forget the piercing winter's blast, and the melting summer's sun, and to think only of the expansion of mercury. It is, then, a very remarkable fact, which has been verified by repeated observations, that when a thermometer is placed under the armpit, under the tongue, or in any position so as to be affected only by the heat of the body, it always stands, in all climates, in all situations, and with whatever person the experiment is made, about the same height, or about the 98th degree. There is some little variation from this. The temperature of infants is somewhat lower; and there are cases of disease recorded, particularly one by Dr. Prevost, of Geneva, in which the temperature of the body was much higher. But in general the mercury stands at the same mark. "Among the pheno-

mena," says M. Despretz, a French author, to whose paper, "On animal heat," a prize was awarded by the French Institute, in 1823, "which the study of physiology offers to our view, there is no one more capable of exciting our attention, than the extraordinary property with which man and all hot blooded animals are endowed, of preserving a temperature nearly equal, though the media around them undergo continual variations. From the very beginning of experimental physiology, enlightened inquirers, such as Haller, Hunter, Bichat, Le Gallois, Dr. J. Davy, and others, have sought after the cause of this extraordinary phenomenon, and have contributed to explain it." But though this particular fact is so extraordinary, it falls so little under the notice of ordinary men, that they, judging by their sensations, imagine their bodies vary in temperature like the things around them. At the same time, there is no person so unobserving or so uninformed as not to know that animals possess a power of generating and creating heat. It is this power which preserves the temperature of the body at the same point, when other objects are much colder. In fact, though the production of animal heat is known to every man, it is so extremely familiar, he having felt it long before he had a capacity for making remarks, it having glowed in his cheek with his first exertion, and been felt at his first blush, that very few persons ever think of inquiring into its cause. It has been said, that a man is fit for a metaphysician when he once doubts the existence of matter; and a man seems, in like manner, fit for an inquirer, who asks himself how the heat is produced which never allows him, during life, though exposed to the greatest degree of cold, to sink down to the temperature of ice. The fact is so familiar, that every man supposes he can explain it, till he makes the attempt; and then he finds, indeed, great difficulties. Ever since the time of Lavoisier, the effect of respiration in contributing to the production of animal heat has been generally admitted, though his theory of respiration has been disputed. That the two are intimately connected, is by no man now denied; and therefore our readers will see the propriety of our having here united them in one article, meaning, as briefly as possible, to give an outline of both.

There have been various theories of the process of respiration; but without discussing them, we shall merely state the best established facts. The atmosphere is composed by measure of about 21 per cent. of oxygen, the remainder being azote, or nitrogen,—about one per cent., in the driest weather, of aqueous vapour, and about the thousandth part of the whole being carbonic acid gas. All other aerial mixtures and gases are in a shorter or longer time destructive of life. Some cannot be respired at all; others again can be respired for a short time, but life cannot be long sustained by breathing any air but the mixture which constitutes the atmosphere. The first well ascertained fact is, that all animals in breathing the atmosphere vitiate the air; a portion of oxygen disappears, and a portion of carbonic acid gas is formed. They take oxygen gas into the lungs, or some corresponding organ, and give out carbonic acid gas. This fact is invariably accompanied by another, namely, that the blood, entering the lungs by the pulmonary artery, changes its colour from dark purple to bright red, loses the properties of venous, and becomes arterial blood. There cannot be any doubt that this change in the blood is the consequence of inhaling oxygen gas and exhaling carbonic acid gas. As carbonic acid gas contains its own volume of oxygen gas, and as the quantity expired is in general nearly equal to the quantity of oxygen which disappears, it has been supposed, and this is the theory most generally adopted at present, that the oxygen inhaled goes immediately to convert the carbon of the venous

blood into carbonic acid gas, and that consequently no oxygen gas is absorbed by the blood. Dr. Edwards, however, has lately shown, from a variety of experiments, described in his work, "*De l'Influences des Agens Physiques sur la vie*," that the carbonic acid gas expired does not always equal the quantity of oxygen inspired; and he has, moreover, shown, by making animals breathe, for a short time, air in which there is no oxygen, that they even then expire carbonic acid gas; whence he concludes that the oxygen inspired is absorbed by the blood, which at the same time gives out carbonic acid gas. This fluid, he supposes, exists in the blood, ready formed; and in support of this view, he mentions the circumstance of carbonic acid gas having been found in the mass of the blood. Between these two explanations, we must leave the reader to decide for himself, remarking, that at present the latter appears to us the more probable, but requires to be confirmed by further experiments. Whichever of the explanations, however, may be adopted, the great fact is still the same, the oxygen of the atmosphere is taken into the lungs, and a quantity of carbonic acid gas, about equal, on ordinary occasions, to the oxygen which disappears, is given out. A common sized man consumes about 46,000 cubic inches of oxygen per day, and makes about twenty respirations in a minute; but these circumstances vary in different individuals. It has also been found, that several circumstances influence the production of the carbonic acid gas in the same individual. Thus it is diminished by taking intoxicating liquors, living on vegetable diet, and by using large quantities of mercury or nitric acid.

As in general no alteration takes place in the quantity of azote contained in a specific quantity of atmospheric air which has been breathed by animals, it has been in general concluded that it was not absorbed, and there have been many doubts as to the use of this large quantity of azote. It is, however, quite clear that it is inhaled, or taken into the lungs, as well as the oxygen with which it is mixed; and some late experiments of the gentleman we have just mentioned, as well as some previously made by Messrs. Allen and Pepys, make it probable that it is absorbed; the quantity absorbed and the quantity exhaled being, in ordinary occasions, about equal. Admitting this, it does not still explain the use of azote in the atmosphere; and we want to know what change it undergoes, if any, and what is the use of absorbing and giving out equal quantities of this fluid. The particular experiments which seem to decide the question, was making animals breathe air in which there was little or no azote, its place being supplied by hydrogen, when it was found that hydrogen was absorbed and azote exhaled. M. Despretz, however, whose name we have already mentioned, denies the absorption of azote, though he admits its constant exhalation, and mentions the experiments of Magendie, which show that the azote is derived from the food, and that animals cannot subsist on food wholly destitute of azote. About this part of respiration, then, there is a doubt; and it remains for future discoverers to decide how and for what purposes all this quantity of azote is employed. The probabilities are in favour of the absorption, and its gradual conversion into the constituent parts of the body; but in this supposition, how the exhaled azote is produced, must still be accounted for. The alternate inhalation into, and exhalation of air from the lungs, with the changes described, constitute the function of respiration.

The question now occurs, How does this process generate heat? It is known that the habitual temperature of an animal is high in proportion as his respiration is active; but how does inhaling and expiring air preserve the body at about an equality of temperature, and carry that heat to the farthest

extremities? It appears to us that this very curious though very common phenomenon is not very satisfactorily explained. It was at first supposed that the oxygen inhaled, combined with the carbon of the blood, and parted with the heat which was latent in it, or kept it in its gaseous state to the blood; that arterial blood contained more specific caloric, or latent heat, than venous blood, which it gave out as it circulated through the body, and was gradually converted into the latter. This theory, which was suggested by Dr. Crawford, has been overthrown by its having been proved that there is not that difference between the specific caloric of arterial and venous blood which Dr. Crawford supposed; nor a sufficient difference between the specific caloric of oxygen gas and carbonic acid gas to make it possible for the former to part with heat to the blood, and at the same time preserve the fluidity of the latter. But Mr. Brodie also found, that when artificial respiration was kept up in the lungs of animals after their heads had been cut off, that carbonic acid gas was formed, and the circulation of the blood kept up, and yet the animal heat was rapidly diminished. Mr. Brodie concluded, therefore, that the production of animal heat is owing to the action of the brain, and not to respiration. A Frenchman, however, M. Le Gallois, has since shown that the heat of animals thus treated continued longer than animals beheaded, and in the heat in which artificial respiration was not kept up; and that animals became cold in proportion as the combination of oxygen diminished. M. Despretz, whose memoir on this subject we have already said was lately crowned by the Academy of Sciences at Paris, made experiments, first to demonstrate the quantity of heat disengaged by the combustion of pure carbon, by which it is converted into carbonic acid gas; and secondly, the quantity of carbonic acid gas formed by the respiration of animals; and the result of his experiments is, that the heat generated by the quantity of carbonic acid produced, judging of that quantity by the quantity given out in the conversion of carbon into carbonic acid is sufficient to preserve the temperature of the body, and that animal heat is caused chiefly by respiration; and, according to the process abovementioned. The union of the carbon of the body with the oxygen of the atmosphere, is a slow combustion, which, as it takes place, produces a constant supply of heat. If we believe, with Dr. Edwards, that the oxygen is absorbed by the blood, and gradually combines with its carbon, this theory seems to gain in probability. But it is inexplicable if we suppose that the conversion or combustion all takes place in the lungs. The objections, too, which have been made to this theory, on account of the little difference in specific caloric of venous and arterial blood, and of carbonic acid and oxygen, do not appear to have much weight, when we reflect that the body in general is never for any considerable time surrounded by media very different from its own temperature, and that consequently a small quantity of heat evolved by the circulation of the blood is sufficient to preserve animals at blood heat. It should also be remarked and remembered, that a quantity of heat sufficient to expand mercury to that point where water boils is destructive of life, and that consequently a very small quantity of heat, as judged of by the expansion of the metal, can alone be requisite for the animal economy. We do not say that the matter is clear; on the contrary, it is not. We will, however, go so far as to assert, that in the present state of our knowledge, the probabilities are, that oxygen gas is absorbed by the blood in the lungs, and that as it circulates through the body, being gradually converted into venous blood, there is also a gradual formation of carbonic acid gas, or a slow combustion which is the source of animal heat. If this be at all a correct view of the matter, then is the pro-

duction of animal heat to be classed with a great variety of other chemical phenomena. If Mr. Brodie's view of the question be correct, it is one of the phenomena which depend exclusively on the principle of vitality, and will have to be explained according to some laws, the outlines or beginning of which man has yet failed to discover.

THE SILVER TREE.

To the Editor of the Chemist.

Sir,—Many of the books on chemistry which I have perused contain very long and intricate accounts of the mode of producing the silver tree, or Arbor Dianæ, equally tiresome and difficult to understand and execute. But the following very short and simple method of producing it I have tried, and with success. If there be any merit in the method it is not mine, for I found it in a late publication, entitled Five Hundred Useful and Amusing Experiments, by George G. Carey, p. 17.

Pour a few drops of quicksilver into a phial containing a solution of nitrate of silver, considerably diluted with distilled water. Leave the phial undisturbed for two or three hours, and the silver will be found precipitated in the form of the branches of a tree.

N. B. I performed the experiment with a small open test-tube, and left it alone all night. In the following morning the expected result was beautifully perfect.

Your younger readers may not object to being informed that the rationale, or principle, of the foregoing experiment is as follows:—As metals cannot be dissolved in acids unless they are combined with oxygen, so they may be recovered from a state of solution, and revived, by deoxydizing them, that is, by depriving them of that portion of oxygen with which they are combined when in solution; and this is effected by introducing another metal, or other substance, which has a greater affinity for oxygen than the metal in solution. Now mercury having a greater affinity for oxygen than silver has, in the foregoing experiment the mercury deoxydizes the silver, which was before combined with the oxygen of the nitric acid in which it was dissolved, to form nitrate of silver, and the silver being thus deoxydized, is precipitated in its pristine metallic form.

If zinc, iron, or any of the metals having a greater affinity for oxygen than mercury, were employed instead of that metal in the foregoing experiment, it would, it seems, produce the same effect. If the nitrate of silver be not sufficiently diluted, the precipitated metal, by its own specific gravity, may fall to the bottom of the vessel in which the experiment is made, instead of remaining suspended in it, which is the chief beauty of the experiment.

Your constant reader,

July 26. Philo Chemicus.

TO MAKE OLD PORT WINE OUT OF NEW.

It is useful to be aware, that port wine may speedily be rendered aged by heat; and in this case it deposits its coat, and assumes the marks of old wine to the eye, as well as to the palate. One year will thus do as much for port as five or six in the ordinary mode of helping, but the period of its entire duration will be comparatively shorter. The effects of heat in maturing port have hitherto been a secret in the hands of a few. In America, it is a well-known practice to boil Madeira wine, or to heat it to the boiling temperature, and the effect is to impart to harsh new wine the qualities of that which is ripe and perfect in flavour. This practice is applicable to port. If newly-bottled wine be exposed to the sun, it shortly begins to deposit its colouring matter, and improves in flavour; and even the rawest wine of this kind may, by heating it in hot water, be caused in the course of a day to assume the quality which it would have had after many years of keeping.

It is so far from injurious, as might be imagined, that it is a valuable secret, and, we believe, one that is but little known, even to those whose interest it is to give the complexion of old wine to new, and who generally effect this purpose in a fraudulent manner, by putting it into foul crusted bottles.—*Encycl. Brit. Supp.* vol. vi.

TO TAKE OUT FRUIT STAINS.

To the Editor of the Chemist.

Sir,—The last communication I sent you was not, I suppose, worth keeping, so you lost it. If this be so, I beg you will give yourself no trouble about it, as it will not trouble me.*

But if it be worth insertion in your weekly paper, (which I constantly see) be it known to all whom it may concern, that having stained my white muslin dress with fruit of different sorts, and being employed in pickling as well as preserving, some vinegar fell upon the stains, and which has had the effect of completely removing them.

If there be any novelty in the application of vinegar for similar purposes, it surely is an easy, simple, and indestructive remedy.

Your humble servant,

A. D.

It would be convenient for ladies who are your correspondents, if there were a letter-box, into which they might put their communications.

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* Our fair Correspondent is quite mistaken in supposing we lost her former communication from entertaining a notion that it was not worth keeping. In fact, we mislaid it from taking too great care of it, and have since found it: hereafter we shall publish it. Her suggestion at the end is already partly complied with, but unfortunately the box is entirely within our publishers' shop.

TO CORRESPONDENTS.

Alpha *will see we have done what was in our power to procure him the best information on the subject he asks about. Previous to his letter reaching us, an article with a drawing describing the mode of preparing nitric and muriatic acids had been got ready, and will appear in No. XXIII. To receive the private information he requests, he will see the necessity of sending some more definite address. A letter to "Alpha, at Leeds," would be like the sailor's, which he addressed, "My Aunt Bet, London."*

Mr. Cobbett neither makes the plat himself, nor has he an agent in London, Z. *He intends, we understand, to take steps to have an establishment. To the latter part of* Z.*'s recommendation we reply, that our principle is, Every individual should buy what he wants wherever he can get it cheapest, best, and most conveniently for himself.*

Cat's-paw's *second note in our next. We shall be happy to hear the result of his experiment.*

C. J. *has been received. His third note is more marvellous than the two former.*

We would readily have inserted the letter of J. M., *Rochester, but he labours under a mistake. One of the books which he quotes, namely, Parke's Catechism, states the fact he alludes to almost in the same words as were used in The Chemist. According to a valuable series of experiments of Count Sickenger, and by the experiments of Mr. Rennie, the following appears to be the tenacity of the different metals mentioned in the article on gold. Wire* 0.078 *of an inch thick, when of iron, supported a weight of* 449.34*lbs.; of copper,* 302.26*lbs.; of platinum,* 274.31*lbs.; of silver,* 187.13*lbs.; and of gold,* 150.07*lbs. If, therefore, a mistake has been committed, it rests with one of the eminent persons whose assertions were quoted.*

**** Communications (post paid) to be addressed to the Editor at the Publishers'.*

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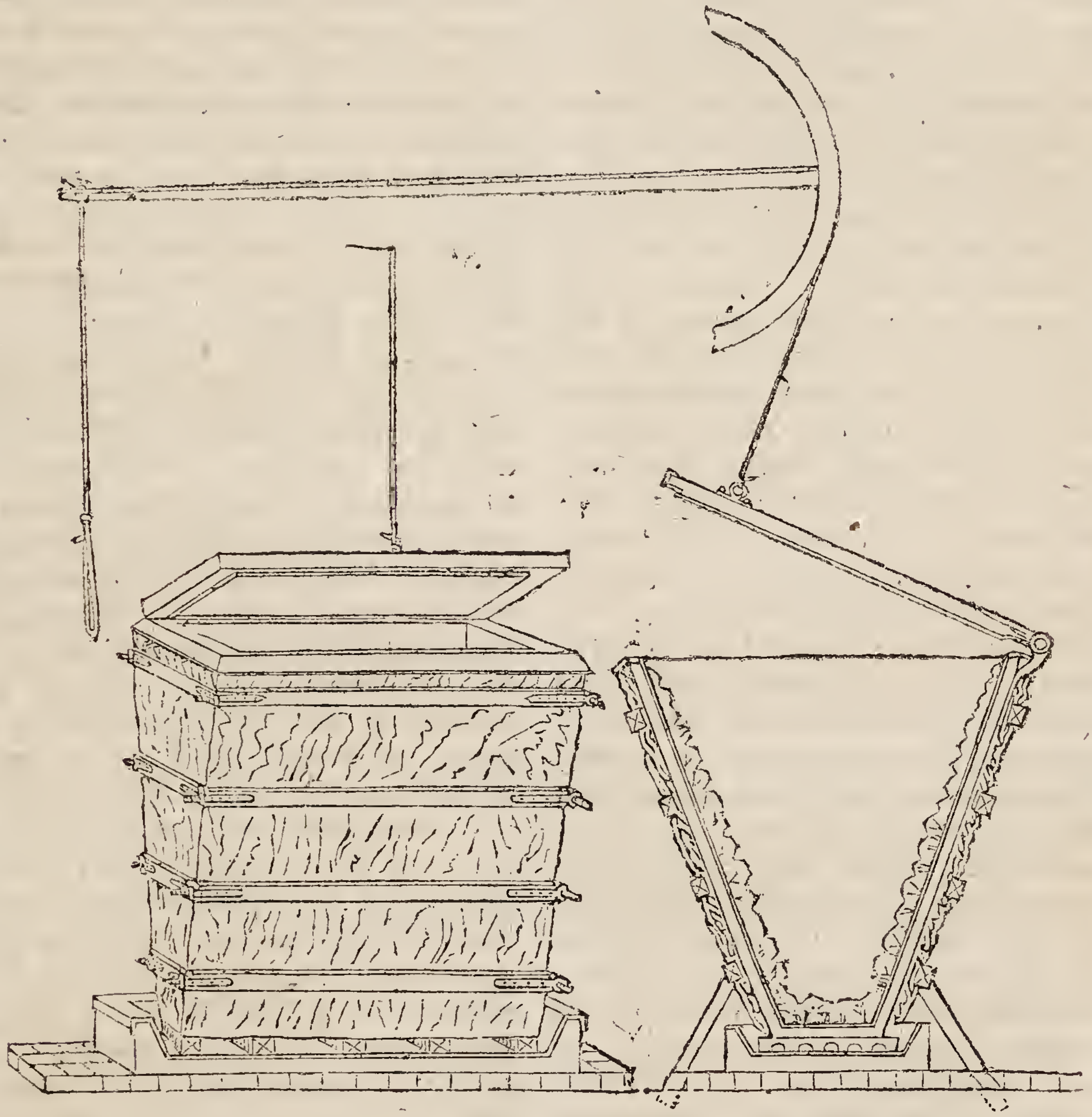
The Chemist.

"——Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if nought in these external scenes
Can move thy wonder?——"

No. XXII.] SATURDAY, AUGUST 7, 1824. [Price 3*d.*



CONTENTS.

MANUFACTORY OF BORAX.

This salt, which is of great use in the arts, being employed as a flux in soldering, and several manufactures, was formerly brought to Europe from the East, and was refined in Holland before it came into the market. We believe it is not yet manufactured in our country; and therefore the following notice of the mode of doing it on the Continent is likely to be of some utility. Borax is a compound of boracic acid, soda, and water; and the late discovery of free boracic acid, in considerable quantities in lakes of hot mineral waters in Tuscany, has led to the establishment on the Continent of manufactories for making borax. By evaporating the water of these lakes in graduating vessels, the acid is obtained at small expense. In consequence of this, borax is no longer imported into France; and within a year several establishments have grown up in that country for manufacturing borax from the boracic acid of Tuscany and the soda made in France. The borax thus manufactured has already found its way into commerce. At first it was introduced as the refined borax of Holland, and then sold for seven francs the kilogramme; in consequence, however, of the success in manufacturing it, the price fell to 2 francs 60 cents. at which it is now sold. The manufactory under the direction of the author of this Article, which we take from the *Dict. Technologique*, is capable, he says, of making 50,000 kilogrammes, or more than 100,000lbs. a year. The mode of proceeding is as follows:—Five hundred kilogrammes of water are boiled in a copper, in which 600 kilogrammes of sub-carbonate of soda are dissolved gradually, 20 kilogrammes being added at a time. The fire is covered with damp charcoal, and the mixture kept just boiling, so that as little vapour as possible escapes, and 500 kilogrammes of the boracic acid of Tuscany is added, gradually and successively, in portions of 10 kilogrammes. At each addition a considerable effervescence takes place, in consequence of the action of the boracic acid on the sub-carbonate of soda and the escape of the carbonic acid. The liquid rises to some height, and care must, therefore, be taken to have coppers sufficiently large; they must be at least double the size necessary to contain the quantity of soda and boracic acid employed. The next portion of acid is not added till the effervescence has wholly subsided. When the whole has been added, and the effervescence has entirely ceased, the fire is lessened or damped, so as to keep the temperature near the boiling point. The copper is covered with a wooden lid lined with lead, and a woollen covering is also put over it to keep in the heat. It is allowed to remain in this state for 30 hours, and then the clear liquid is drawn off, by means of a cock or syphon, into vessels for crystallization. They are of considerable dimensions; and the solution should not be above 25 or 30 *centimetres* deep, in order that the cooling may be more rapid. At the end of three days in winter, and four in summer, the crystallization is complete. The mother water is drawn off and employed in the next operation, instead of water, to dissolve more subcarbonate. Crystals of borax are deposited at the bottom and sides, to which they adhere firmly, and must be removed cautiously. They are again dissolved in boiling water, and 10 kilogrammes of subcarbonate added to every 100 of the borax. This solution should be at 20° of the areometer of Beaumé, and at least 1000 kilogrammes of borax must be dissolved at the same time to obtain large crystals, they being in size always in proportion to the mass. When the whole is again dissolved, it is drawn while boiling into a vessel for crystallization. This should have the form of a truncated pyramid, as represented in the plate, be constructed of considerable thickness, so as not to be easily shook, and be lined with lead. The lower base is a rect-

angle, 166 centimetres long, and 34 broad; its upper part is a square, each side of which measures 166 centimetres; its perpendicular height is 170 centimetres. The whole should be covered with thick woollen cloth, and placed on some secure foundation. To carry on the operation continually, 18 such vessels are necessary, for it takes 17 or 18 days before the borax is cooled to the proper temperature, viz. that of 30° *cent.* or 80° Fahr. The place for the crystallization should be separated from the places where the other parts of the operation are carried on, in order that it may not be disturbed by the vessels receiving the least shock; and the temperature of the room ought as much as possible to be invariable, and about 18° cent. or 65° Fahr.

When the crystallization is completed, which is known by the temperature arriving at the point mentioned above, the lid is removed by the aid of a machine, the mother water is drawn off by a syphon, and then the lid is again closed and kept so for six or eight hours, in order that the heat may be slowly disengaged, and the crystals may not crack by a sudden alteration of temperature. The lid is then again removed, and a workman gets into the crystallizing vessel, and breaks off the crystals, one by one, from the sides. They are afterwards separated and sorted, and the small ones again dissolved. Those which are discoloured by spots of borate of lime or magnesia, are cleaned from these spots by knives and hammers. The borax is then kept in a dry place, in which a fire is lighted in winter for some days, and is afterwards, when sufficiently dry, agitated in a basket to rub off the fine angles of the crystals, and make it more like the borax which is purified in Holland. It is then packed up and sent to market. This is one example, though a comparatively trifling one, of the manner in which chemistry has taught men how to make those articles for themselves they before merely gathered from nature, or imported from abroad. We suppose it might be advantageous to import boracic acid from Tuscany, and manufacture borax in some parts of Great Britain, instead of continuing to import the article from other countries.

CHEMISTRY AS A SCIENCE.
Art. XXI.
ARSENIC. ANTIMONY.

We have already had occasion to mention (Chemist, p. 12, No. I.) that the substance known in commerce by the name of "arsenic," is called *arsenious acid*, and white oxide of arsenic by chemists. This substance is found native, and is moreover frequently formed in the process of extracting other metals from their ores, and can thus be abundantly procured without further trouble. The basis of this peculiar substance is a metal, and to this metal the chemists restrict the name of arsenic. If the white oxide be fused with twice its weight of soft soap, and an equal quantity of alkali, and it be poured, when fused, into a hot iron cone, the metal will be obtained. Or it may be mixed in a state of powder with oil, and exposed in a matrass to the heat of a sand-bath. This is an offensive process, and can only be performed where there is a brisk current of air to carry off the vapours. The decomposed oil rises first, and the arsenic is afterwards sublimed in the form of a flaky metallic substance. The metal may also be obtained by mixing arsenious acid with half its weight of blax flux, and putting the mixture in a crucible, placing another over it, inverted, and luting both together with clay and sand. Apply a red heat to the lower vessel, when the arsenic will be sublimed and deposited on the inside of the upper crucible. The metal thus obtained has a bluish white colour, somewhat like that of steel, and it possesses a good deal of brilliancy. When heated it emits a strong and very characteristic odour, resembling the smell of garlic. It is one of the softest of the metals, and is so brittle that

it may be reduced to powder in a mortar. When a strong heat is applied it does not melt, but rises in vapour. Water does not affect it, but when exposed to the air it becomes black, and falls into powder. With one of its oxides we have already made our readers acquainted, and of its effects as a poison, under the name of 'arsenic,' they have all heard. In all the states with which we are acquainted with arsenic, it is a poison, though it is prescribed in agues, and with beneficial effects. Realgar, which is a sulphuret of arsenic, is formed by the Chinese into cups, and lemon juice which has stood in them for a considerable time is used as a tonic. Arsenic unites with other metals, and when copper is alloyed with it, it becomes more malleable and flexible, and takes a fine polish. Articles which are to be plated are, on this account, frequently made of this alloy. It forms one of the ingredients also in the specula of reflecting telescopes; and mixed with lead, which it makes more brittle and more disposed to granulate, it enters into the composition of shot. Its oxides and sulphurets are employed by the dyer, they are useful in purifying flint glass; they form valuable pigments, and are of service in many of the arts. As a metal, arsenic is put separately to no use, and seems not individually adapted to any specific purpose.

Antimony, the next metal we have to mention, is employed, as well as arsenic, in medicine, though it is not so violent a poison. There is reason to believe that an ore of this metal was known in the time of the Romans, and was in use as an external application for sore eyes. Admitting the very deleterious nature of some metals, such as arsenic, copper, lead, mercury, &c. it is still difficult to conceive what there is in them so baneful that it cannot be equalled by the productions of the vegetable kingdom, and what therefore has been the source of that prejudice which vaunts the health-giving properties of herbs, and teaches men that mineral medicines are all to be avoided. We see a considerable number of shops and establishments in the metropolis, particularly in the eastern part of it, for curing all diseases by means of herbs. But surely a man may be as effectually poisoned by hemlock, or hellebore, or laurel leaves, or opium, or nux vomica, or the juice of the upas tree, as by oxide of antimony, or sulphuric acid. There is no ground whatever, therefore, for the prejudice, and disease or painful death may ensue from an improper use of herbs, which is seen even in cattle, as well as from an improper use of minerals. Discretion, ever-vigilant and watchful discretion, guided by knowledge, is necessary in both cases, and discarding prejudices, whether of antiquity or of present imaginings, we ought to rely on it as our surest and best guide. Long experience has shown that both mineral and vegetable *poisons* are, in the hands of skilful practitioners, specifics against certain diseases, enabling them to mitigate pain and preserve life. What we have to avoid are those ignorant and pretending quacks and empyries, who address themselves to our fears and our prejudices, incited by no other motive but to gain their living or a fortune, and never care in this pursuit whether or not the health of their patients is wrecked and their lives sacrificed. We should all take no more medicine than we can possibly help; never take any without its being prescribed for us by somebody who understands the matter, but certainly we should then have no worse opinion of mineral than of vegetable poisons. Some preparations of antimony have been very long in use as medicine, and a few years ago it was the fashionable specific of the day. Long after the notion of a universal medicine was exploded among sensible men, antimony was raised to that rank by the zeal of its partisans. By others indeed it was as loudly decried, and no poison was supposed to be so virulent as antimony, in all its shapes and forms.

At present men are more sober concerning both its virtues and its deleterious qualities; it is neither a specific for all diseases, nor in all cases a deadly poison; it occupies a more subordinate place in the pharmacopœia, but still tartarised antimony is classed as a most valuable medicine. Of the virtues of Dr. James's fever powders there seems no doubt, and there is as little that the kermes mineral is a useful medicine, and both these also are preparations of antimony.

What is called antimony in the shops, is a sulphuret of the metal. Ores of antimony have been found in Sweden, Saxony, Hungary, and Norway, and in North America. The pure sulphuret is separated from the earth with which it is contaminated by being exposed to heat in a strong reverberatory furnace, and the metal is afterwards to be obtained by fusing the sulphuret with crude tartar and saltpetre. In this state it was formerly called regulus of antimony, and now simply antimony. In consequence of the disputes concerning its nature, it has been very closely and frequently examined. It is of a greyish white colour, and tolerably brilliant. It has a curious kind of laminated texture, as of thin plates crossing each other, and sometimes it assumes the form of crystals. It is about as hard as gold, and as brittle as arsenic. It melts at a degree corresponding to 810 of Fahr. and at a still higher heat rises in vapour. It is not altered either by air or water, except losing its lustre. But steam, when made to pass over red hot antimony, is decomposed very rapidly and with a violent detonation. It unites with oxygen, and its oxides are used as medicines; it combines also with other metals, forming alloys, some of which are of considerable use. When combined with iron, it diminishes its magnetic power in a very remarkable degree. A very small quantity of it also destroys the ductility of gold. A proportion of it, not exceeding 1-1920th part of the gold was found by Mr. Hutchett to make this metal perfectly brittle. Even the fumes of antimony in the neighbourhood of melted gold are sufficient to destroy its ductility. Great attention was formerly paid to this alloy, because the alchymists thought the quantity of gold might be increased by mixing it with antimony. As a metal antimony is put to no separate and distinct use; but it is one of the ingredients of the alloy of which printers' types, and also of that alloy of which the specula of telescopes, are made. Formerly a sulphuret of antimony was used by the ladies to stain their eye-lashes black; but northern beauties, finding that this was not always an embellishment to their complexions, have either laid aside, or never adopted this cosmetic, and seem, at present, to content themselves with giving to their skins the tints of roses, pinks, and lilies.

ANALYSIS OF SCIENTIFIC JOURNALS.

ANNALS OF PHILOSOPHY FOR AUGUST.

The present Number of the Annals is so uninteresting that we are almost sorry to waste on it so much of our space as is necessary to give a brief outline of its contents. Mr. Baden Powell, M.A. F.R.S. continues his remarks on Solar Light and Heat, and condescends to inform us, which is an opinion not remarkably new, nor remarkably well proved, that black bodies are heated more than white ones *by the light* they absorb. As t his estimate of quantity of light and number of rays, we have no notion how he measured or numbered what can neither be grasped or weighed, and which, though it can be excluded, is not to be divided. Mr. Powell's statements are very logical and correct on the supposition that the *cause* of vision is a distinct *substance*, and that this distinct substance is reflected in much greater quantities by white than by black surfaces; but according to the general meaning of terms, the propriety is not evident of applying the name of *substance* to the un-

known cause of vision, and which has for us no other properties whatever than the single one of making us see. Light is something in perfect harmony with the structure of our eyes, is adapted to them, and, as we know by the blind, has no action whatever for us but through the instrumentality of our organ of vision. To call it a *substance* is only an example of an eagerness to account for phenomena before they are accurately observed. There is, however, no occasion for this, as the wisest of philosophers and most enlightened observers, they who have pushed their inquiries furthest, and pryed, most deeply into the wonders of the goodly imagery around us all, agree, that wherever our researches may stop, the last fact we can ascertain will be as much replete with wonder, and as much, or indeed infinitely more demand an explanation, than those facts we now endeavour to explain. If this is necessarily to be the end of our researches, as every man of sense knows that it must, why should we jump to it, by inventing explanations, past all the phenomena which lie between our first conceptions and this ultimate conclusion? We wish particularly to caution our readers against the very general mistake of supposing that a phenomenon is explained whenever it receives a name. In almost every branch of science we find curiosity satisfied, and researches stopped by the invention of some pretty sounding noun substantive, on which the mind reposes as if nothing further were to be learned. Calling light a *substance* gives unnecessary complication to the phenomena, at the same time that it checks research by begetting a notion that the matter is already explained. Mr. Baden Powell has only in this respect adopted the general opinion, and has advanced nothing new. It has been stated over and over again, that black surfaces, exposed to the sun, grow hotter than white ones, and we do not see that Mr. Powell, in his elaborate paper has gone a single step beyond this fact. That what causes vision also causes this greater *heat* in the black than the white, is by no means proved. We remarked, in speaking of the former part of Mr. Powell's paper, that the sun's rise above the horizon and the spread of light were coincident, while the heating effect of the sun was not brought into action for hours. Even in Mr. Powell's experiments, the white and black surfaces, the reflection from which caused different degrees of heat, were instantaneously *seen*, while the expansion of the mercury in the thermometer, taken as the evidence of heat, was not complete for a minute. We repeat, then, when effects are not coincident in time, and are so perfectly distinct as sensations of heat and sensations of sight, which every child distinguishes, that it is at least a hasty explanation to ascribe them both to the same cause. For our parts we are willing to admit that both are caused by the sun; but that there is an intervening substance, called *light*, transmitted from the sun, possessing we know not what sort of properties, but producing both sensations of heat and of sight, seems to us one of those useless inventions with which learned men have in all ages encumbered the beautiful simplicity, and have not explained the phenomena of the universe.

A paper by Sir H. Davy is taken from the Philosophical Transactions, and its substance has already appeared in some weekly publications. Then comes an analysis of the metal of a statue found at Lillebonne, which seems published solely for the purpose of paying a compliment to Sir Humphrey, by contrasting his views with those of M. Vauquelin, and showing that the oxidation of the metal of this statue was occasioned by its having been gilded. The gold and the copper having formed, with the moisture of the earth, a voltaic circuit, and thus promoted the oxidation of the copper. This is a conjecture of M. Labillardiere, and is very ingenious, particularly as cor-

roborating and corroborated by the late experiments of Sir H. Davy. In another part of the Annals this subject is again alluded to. We published in The Chemist, No. V., a letter, disputing in some measure the merit of Sir H. Davy, as to the discovery of his method of preserving copper sheathing; but we accompanied that letter by some remarks, to show, even if the patentee there mentioned had anticipated Sir H. Davy, which we did not believe, the value of the application by the latter gentleman was not diminished, and the principles which led him to it were certainly not known to the other. Mr. Children, in the present Number of the Annals, reverts to this letter, not, however, as it appeared in The Chemist, but in a cotemporary publication, and hastens, with considerable zeal and warmth, to uphold the extraordinary merit of the President of the Royal Society, of which Mr. Children is a member.

We have a very high respect for the illustrious President; but among his partisans and followers, those who belong to *his* scientific *sect*, and look up to him and his Society for approbation and support, there is a narrow and jealous apprehension of all other scientific men. Sir H. Davy's merits are so great, that they can only be exalted by just comparisons; and it is both unwise and harsh in those who are immediately connected with him, to show such a feverish anxiety to maintain his superiority. The President must at least be considered as having been born at a very *fortunate* period, as it gave him an opportunity, which he has well employed, of applying an important discovery, made by others. The *electricity*, and the instruments by which he has risen to fame, do not bear the name of DAVY, but of VOLTA and GALVANI.

There are two papers by Mr. Gray, on the Classification of Insects; two by Berzelius, the Swedish chemist, one on Silica, the substance of which has already appeared in The Chemist; and on the Mineral Waters of Carlsbad, in Germany. There is a paper by Dr. Prout, on the acid sometimes found in the stomach, which has already appeared in the periodicals; an account of a rain gauge, an analysis of baryto-calcite, and an astronomical paper, by Colonel Beaufoy. There is no plate; the scientific notices are all old; and the greater part of the articles are mere reprints from other works. Every paper, however, is the production of some person who writes a great many letters after his name, and the editors take special care to inform the world that both are F.R.S. L. and E. F.L.S., &c., as if they supposed learned titles were a security against dulness and ignorance, and that the world would believe, because a man was admitted among the oligarchs of science, that he was both wise and witty.

TO PREPARE CITRIC ACID.

ACIDUM CITRICUM.

To a pint of lemon juice add as much prepared chalk (about an ounce) as will be sufficient to saturate the juice; mix them, and then pour off the fluid; wash the citrate of lime which remains repeatedly with water; then dry it. Afterwards pour nine fluid ounces of diluted sulphuric acid upon the dried powder; boil for ten minutes; press the liquor strongly through a linen cloth, and filter it through paper. Evaporate the clear fluid with a gentle heat, so that as it cools, crystals may form. To render them pure, dissolve them a second and a third time in water; filter the solution through paper, and set by to crystallize.—*Pharmacopœia.*

GUM MAKES OIL UNITE WITH WATER.

IT is said that dried gum, soaked in oil, makes the latter unite readily with water. This takes place even by pouring oil into a mortar, adding water; then throwing in gum arabic, in powder, and shaking or stirring the mixture well.—*Bulletin des Sciences Technologiques.*

DICTIONARY OF CHEMISTRY.

Benzoin, *benjamin, styrax, benzoe.* Names given to the tree from which the benzoic acid is obtained. It exudes in the form of a thick white balsam.

Beryl, *aqua marina.* A precious stone, composed of 68 silica, 15 alumina, 14 glucina, 1 oxide of iron, 2 lime. It is harder than the emerald, and differs from it somewhat in colour.

Bezoardic. The name at first given to uric acid.

Bezoars. Concretions found in the stomachs of animals, and formerly supposed to have great medical virtues. They are of several kinds, and some which the king of Prussia sent to Bonaparte were found by Berthollet to be woody fibres agglomerated.

Bihydroguret of Carbon, *carburetted hydrogen, heavy inflammable air.* A compound of carbon and hydrogen.

Bihydroguret of Phosphorus, *phosphuretted hydrogen.*

Bildstein, *figure stone, agalmatolite*, which see.

Bile. A bitter yellowish liquid, secreted by animals, and, it is supposed, from the venous blood. It is chiefly composed of, in 1100 parts, 1000 water, from 2 to 10 yellow insoluble matter, 42 albumen, 41 resin, 5.6 soda, 45 phosphates of soda and lime, sulphate and muriate of soda, and oxide of iron.

Biliary Calculi, *gall stones.* Secretions formed in the gall bladder, or in the duct through which the gall passes into the intestinal canal. There are several species, which are named according to their constituent parts.

Birdlime. A peculiar vegetable principle which exudes naturally from several plants, and is also made from several, in this country chiefly from holly, has received the name of birdlime.

Bismuth. A peculiar metal, of a reddish white colour.

———, Butter of, *chloride of bismuth.*

———, Magistery of, *nitrate of bismuth.*

Bistre. A brown paint, prepared from soot.

Bitter Principle. The name given by chemists to a substance extracted from several vegetables, such as coffee, coculus indicus, &c. &c., distinguished by the intensity of its bitter taste, but variously modified, according to the plant from which it is procured.

Bittern. The water which remains after salt has been obtained from it.

Bitumen. A general name for a class of inflammable mineral substances, some of which are fluid, as naphtha, petroleum, Barbadoes tar, &c.; and some solid, as asphaltum or mineral pitch, mineral tallow, and elastic bitumen or mineral caoutchouc, &c.

Black Jack, *mock lead.* An ore of zinc.

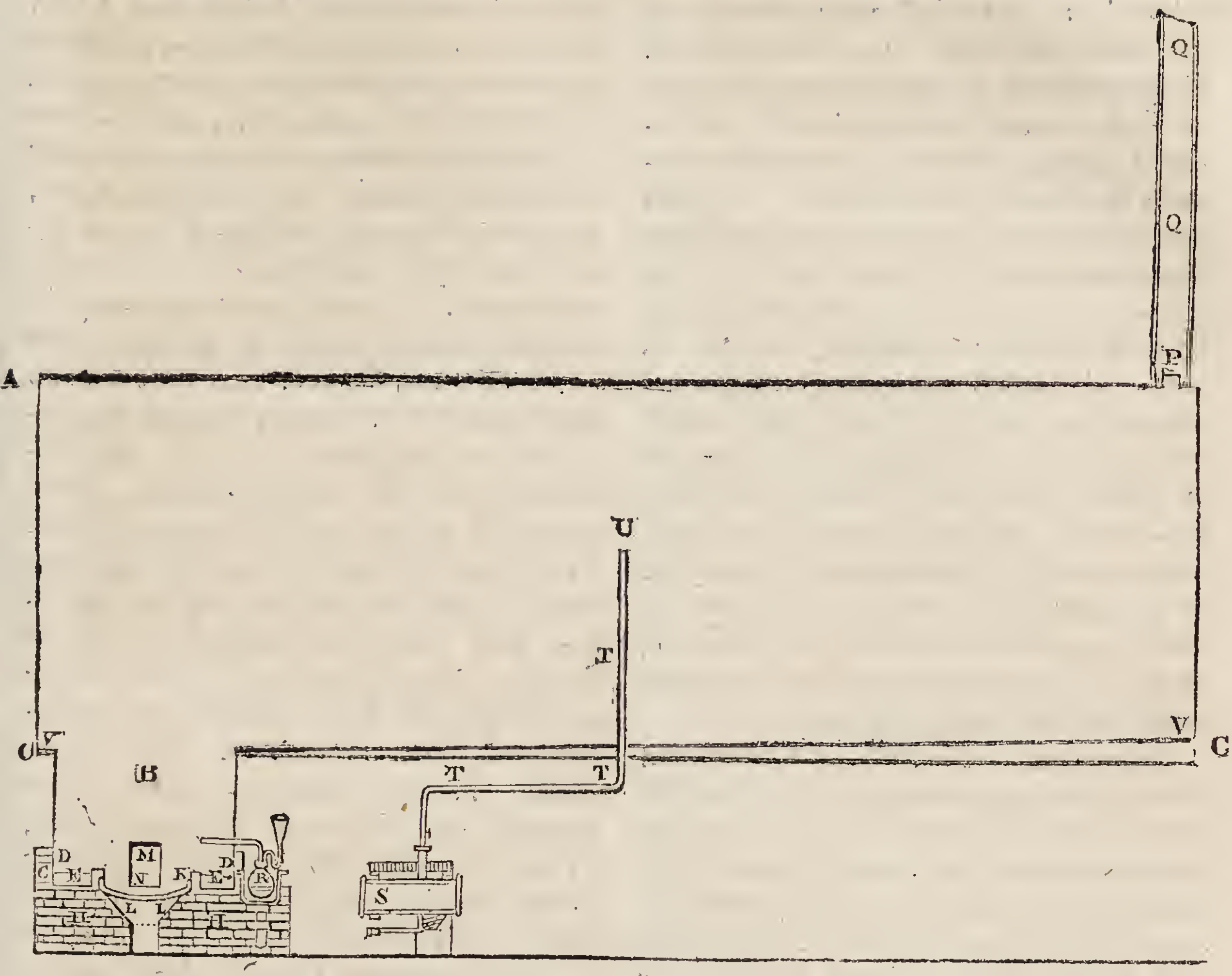
Black Lead, *plumbago, graphite.* A well-known mineral substance, consisting of 91 carbon and 9 iron.

Black Wadd. An ore of manganese.

Bleaching. The chemical art by which various substances used for clothing, food, and other purposes, such as wax for candles, are rendered white.

CURIOUS EXPERIMENTS.

In 1778, Herrissant, a French philosopher, enclosed three toads in boxes, and covered the boxes with plaster of Paris, to the complete exclusion of air. He then deposited the boxes at the Academy of Sciences, at Paris, and in 18 months afterwards they were opened. Two of the toads were found living, and one dead. Unfortunately, the dimensions of the boxes have not been recorded. Dr. Edwards, from whose writings we have taken this account, lately made some experiments of a similar nature; and he seems to have proved that whatever care may be taken completely to bury a toad in plaster, the air will penetrate; that it is transmitted through the material; which is probably also the case when toads have been known to live enclosed in stones and wood, and that when these animals are completely excluded from the air, by the interposition of water or mercury, they speedily die.



MANUFACTURE OF SULPHURIC ACID.

(FRENCH METHOD.)

(*From the Dictionnaire Technologique des Arts et des Metiers.*)

THE principles of this method are the same as those of the method followed in England; but some of the details seem different, though we will not decide that they are superior. Forty years ago, we are told, sulphuric acid was manufactured in France in a very imperfect manner. The process then consisted in shoving into a chamber lined with lead, containing from five to ten thousand cubic feet, an iron *chariot*, carrying a capsule of cast metal full of burning sulphur, the combustion of which was promoted by a portion of nitre, amounting to 10, 15, or even 20, in the hundred. When it was supposed that the combustion was completed, and that the acid formed had been condensed by the water, the door was opened at which the chariot had been introduced, it was taken out to clear away the residuum, again loaded, and the operation repeated. The acid obtained was evaporated and concentrated in leaden boilers, and then concentrated in glass retorts, ranged, as many as 20 or 30, in rows, and all heated by the same fire. The result of all these proceedings was to obtain from 150 to 200 parts of sulphuric acid, of the specific gravity of 1.845 for every 100 of sulphur employed, and very often the operation entirely failed. Afterwards the chariots were done away, and an immoveable furnace constructed under the chamber. (This is the first decided difference we find between the English and French methods.) The plate on which the sulphur was burnt was heated by an exterior fire, and the mixture of 100 parts sulphur to 10 or 12 saltpetre could be regulated and fed at pleasure by means of a small door for this purpose. A hole, two inches above the level of the sulphur, permitted a constant ingress of air, and a chimney at the other extremity created a draught which carried off the uncondensed gases. In damp weather particularly, they fell all around, and destroyed all vegetation in a pretty extensive circle. Some acid was always left in the chamber; and as more was

formed, a quantity was drawn off and concentrated in glass vessels. This method is still generally employed, except that, instead of several glass retorts, a single platinum boiler is now in use. By this process, from 100 parts of sulphur from 250 to 260 of acid, of the specific gravity of 1.845, are obtained. The following method, which is only practised by some manufacturers, is said to give constantly 300 of acid of the specific gravity of 1.845, for every 100 of sulphur. According to the theoretical calculation of the definite proportions, of sulphur 100, oxygen 150, water 62.50, the sum would be 312.50, and it is scarcely possible to come nearer on a large scale.

The best size for the chambers is said to be about 50 feet in length, 27 in breadth, and 15 in height, or rooms containing about 20,000 cubic feet; chambers of different dimensions may be used, but this size is the best. Such a chamber is represented in the plate by the letters A, C C. A leaden cylinder, B, eight feet in diameter and six feet in height, enters the chamber at one end, and rises about six inches above the floor, C C. The cylinder at its lower part, D D, turns inwards and upwards, and forms a a gutter, E E, concentric to the cylinder, in which there is a constant quantity of acid kept as high as G, to prevent the lead from getting too much heated, and to profit by the heat of the acid which continually passes. The whole is placed on the masonry, H, in the middle of which there is a plate, K, three feet four inches in diameter and one inch thick, slightly concave, and having rims three inches above the fire, L L, which ought to heat all its under surface. Level with the rims, a door, M, is made into the leaden cylinder, two feet long, eight inches wide, and having at its lower part a hole, N, an inch in diameter. At the other end of the chamber are two valves and two wooden chimnies, sufficiently high to promote a strong draught. Every thing being ready, the door and the valves closed, the fire is lighted under the plate; and when it is so hot that a handful of sulphur thrown on it instantly takes fire, it is loaded with sulphur, and takes 50 kilogrammes, about 115lbs, for every operation. At the same time, a retort, R, containing 9¾lbs. of nitric acid and 1lb. 4oz. of molasses, is heated. The nitrous gas disengaged is conducted by a tube into the leaden cylinder, two feet above the burning sulphur; and this operation is continued till all the nitrous gas is disengaged: what remains in the retort is employed to make oxalic acid. About two hours after the beginning of burning the sulphur, the cock of a boiler, S, is opened, the tube of which, T T T, enters the middle of the chamber. Its diameter is one inch, which at its mouth is reduced to six lines, in order that the vapour arising from the boiling water in S may issue with some force. This cock is to be kept open till all the vapour necessary for the absorption of the acid has been thrown into the chamber. Soon after the introduction of the vapour a condensation in the interior is perceptible, and the hole, N, is opened in order to give access to the atmospheric air.

In general, the injection of vapour is stopped about an hour after the combustion of the sulphur, and when this is done, and it is supposed that the condensation is complete, the door of the cylinder and the two valves are opened, in order to renew the air of the chamber, and another operation is then begun. Four times this may be repeated in 24 hours, but it is difficult to keep up a constant work. It is better to perform only three, and even as two require less close inspection, the apparatus being less liable to accidents, and more produce in proportion being obtained, it is perhaps on the whole better only to work it twice in the 24 hours. The metal suffers considerably less under this mode of operating. The bottom of the chamber should always be covered with liquid, and as it is laid in-

clined to the horizon, the liquid is deeper at one end than the other. The concentration can be carried on in the chamber to a considerable extent, but then the acid absorbs a portion of the nitrous gas, from which it is impossible afterwards to free it. In consequence of the water necessary for the acid being furnished from vapour, and thus being distilled, the acid obtained is not contaminated with sulphate of lime.

If it is ever found necessary to draw off the whole of the acid from the chamber, to make repairs, or from any other cause, care must be taken to cover the bottom of the chamber, before beginning anew, with weak acid. Some manufacturers, who have neglected this precaution, have obtained no product. Heat and water are essential to the formation of the acid; and it has been observed, when working by the method called "with a continued current," that in dry weather, particularly dry frosty weather, that the acid was never condensed. As the cause of this circumstance was not known, it was attributed to the chambers, which were said to be sick, and would not work. The remedy is, to inject vapour of water into the chamber, and thus both moisten and heat it.

We have met with no accurate estimate of the quantity of acid obtained in England from the combustion of sulphur in our manufactories of this article, to enable us to compare accurately the value of the two methods. If, however, the French statement we have given above is correct, we should suppose the latter the most profitable. The only drawback we see, is the recommendation not to repeat the operation more than three times in the 24 hours, while, by the English method, the work is constantly going on. This is a point of great importance, in consequence of the large capital embarked in such manufactories; but we must at the same time remark, that we see no reason why the English method should not cause as much injury to the buildings and machinery as the French. Independent of this, the latter seems to have considerable advantages. The substituting a plate exposed to exterior heat, and the mixing the nitrous gas with the flame of the sulphur, instead of mixing the two substances together, and the method of injecting vapour, supplying both heat and pure water, must unquestionably produce a greater quantity of acid than is obtained by the English method, and of a purer nature. Whether this advantage is sufficiently great to counterbalance the expense of the fuel consumed, we have no means of determining, but we have the testimony of the French manufacturer in its favour. The English method is by him styled the old method, and one that has been rejected on account of its disadvantages. This is a point we must leave to be decided by the manufacturer himself, and shall be satisfied if our short account of the French method should either beget an improvement in our own, or a thorough conviction in those interested, that the practice they follow is better than that of their continental neighbours.

SULPHURETTED HYDROGEN.

To the Editor of the Chemist.

SIR,—In compliance with your request, I beg to inform you, that the process to which I alluded in my last was in preparing the sulphur præcipitatum (formerly lac sulphuris) according to the *old* formula, viz. precipitating the sulphur from the hydroguretted sulphuret of lime by *sulphuric* acid. There can, I presume, be no question as to the gas emitted being sulphuretted hydrogen. M. Chaussier may justly deserve the high reputation he enjoys, and I am not disposed to doubt generally the truth of his statements; I can only repeat, that I once myself experienced the effect of incautiously inhaling sulphuretted hydrogen, which was merely a temporary suspension of all the animal functions,

and subsequently great depression of nervous energy.

I intend in the course of the week to try M. Chaussier's experiment on a cat, the result of which you shall know.

Your obedient servant,
CAT'S-PAW.

It may, perhaps, be useful to some of your experimental readers, to caution them in preparing this gas from the potassæ sulphuretum, which is often done, not to use the article so called in pharmacy, which is usually made with the potassæ subcarbonas; for this purpose it should be made with the pure potassæ.

July 26.

METHOD OF PLATING ON COPPER.

THE following method of performing this much-practised art is recommended by the French Academy of Sciences. Whether it is more advantageous or not than the method employed by our own artists we will not determine, but we think it worth insertion in our pages, that those who have an opportunity may put it to the test of experiment. Two powders are to be prepared in the following manner. Dissolve silver in nitric acid, and then precipitate it by means of strips of copper, perfectly clean. The copper is to be left in the solution till it is covered with silver, or no more is deposited on it. It is then to be immersed in pure water, when the silver separates from the copper, and subsides to the bottom in fine powder. Take of this silver, thoroughly dried, one part; muriate of silver, washed and thoroughly dried, one part; borax, purified and calcined, two parts; mix them together, and reduce them in a mortar to a fine powder, which can be sifted through silk: this is powder No. 1. Take of this powder one part, of pure sal ammoniac one part, muriate of soda, pure, one part, sulphate of zinc, one part, and the substance which rises to the top of the furnace where glass is melted, and which is a mixture of several different salts in variable proportions, one part. Mix them intimately, and pulverize them together, first in a glass, and afterwards on a porphyry slab. Moisten it gradually with pure water, or water mixed with a small quantity of gum, till it is of the consistence of paste, and can be laid on with a fine brush. This is No. 2. Take a piece of copper, well cleaned and polished, moisten its surface with a brush dipped in water, holding in solution a small quantity of muriate of soda; spread gradually over the metal the powder No. 1, so that it forms a thin layer. A convenient means of spreading it is to sift it through a fine searce. The metal thus prepared is put in the middle of charcoal, burning briskly, and is kept there till it is red hot, which soon takes place. Withdraw it, and plunge it for a short time in boiling water, quite pure, or holding in solution a small quantity of sea salt or cream of tartar; after it is taken out, its surface is scrubbed with a wire brush, to remove a small layer of impurities. It is found that the copper thus exposed is penetrated by the silver, which forms a part of it, and the metal then appears plated. No. 2 is then applied to the surface, with a fine brush, and the metal is put in the fire till it is cherry red, when it is withdrawn, plunged in boiling water, and afterwards scrubbed with a wire brush in cold water. This second part of the process is repeated four or five times, after the metal is sufficiently plated. It has, in this state, the appearance of deadened silver, but may be polished in the same manner as silver.

It has been found by breaking pieces of copper plated in this way, that the silver had penetrated it, which gives great solidity to this sort of work. Another advantage said to belong to this method is, that the plating can be easily repaired, while, when the process is carried on in the ordinary way by silver leaf, the whole must be removed to plate the copper anew.

It is only necessary to apply the method we have described to the places worn out, and they are again made as good as new. It is another advantage of this method that it may be practised with the smallest pieces of metal, and with ornamental work, which is very difficult to accomplish by the ordinary means, particularly if the surface is in relief.

TO DISTIL SPIRIT FROM POTATOES.

The practice of distilling spirit from potatoes has been long adopted with considerable success; we do not give the following plan, therefore, as novel in its principle, but perhaps practical men may find that it possesses advantages. The inventor of this peculiar process is M. Siemen, of Pyrmont; and it has been successfully acted on in various parts of the Continent, particularly in Sweden and Denmark, to both of which M. Siemen was invited to put it into execution. The potatoes, by means of an apparatus constructed for this purpose, are first heated by steam, a little above the boiling point of water. They are then mashed by means of an iron instrument, which turns round in the apparatus, and makes a finer meal than if the potatoes were either pounded or rasped. The meal of the potatoes is then mixed with hot water, and about one pound of potash, rendered caustic by lime, is added to every three or four tons of potatoes. All the mucilage, which, when the potatoes are boiled, remains in general insoluble, is thus converted into a thin paste, which passes easily through a grating made in the apparatus, where nothing is left but the skins. The pulp is to be cooled as quickly as possible, and then is ready for fermentation. A quantity of yeast is added, and the fermentation supplies not only a sufficient quantity of yeast for subsequent operations, but even for sale. By this mode, it is said, nearly double the quantity of spirit is obtained, from a determinate quantity of potatoes, than by the old method. The fermented liquid is distilled like any other liquid.

EFFECT OF AIR ON LIFE.

It is a well known fact, that the oxygen of the air which is inspired converts the dark red venous blood into bright red arterial blood; and also, that the action of venous blood is totally different from that of arterial blood on the brain and spinal marrow, stopping their action and the action of the heart, and causing death. From this, it has been somewhat rashly concluded, that the air inspired had no other effect; and that the exclusion of the air preventing the conversion of venous into arterial blood, was the cause of death. It has been lately shown, in a work published at Paris, and in French, by an English gentleman, resident there, that the air has more influence than this. By a series of experiments, which, as they were cruel, we will not repeat, as we can never think it beneficial to man to improve science at the expense of humanity, he has shown that the air has a considerable influence in sustaining life after the heart is removed, and consequently when that change in the blood, to which its influence was exclusively ascribed, does not exist. He afterwards proved the same fact, by exposing some frogs, with their heads closely covered, to the action of water, while others were exposed to the action of air; and the latter lived a considerable time longer than the former. Some doubts may be entertained, however, whether these animals do not inhale air by the skin.

TO RECTIFY AND WASH ETHER.

In answer to a Correspondent, we must observe, that the ether obtained in the shops will need rectifying as well as washing, and therefore we subjoin directions for performing both. Half an ounce or a proportionate quantity of fused potash must be dissolved in two fluid ounces of distilled wa-

ter, and to this add fourteen fluid ounces of ether, and shake them well until they are mixed. Place the mixture in a water or sand-bath, about the temperature of 200°, and distil over 12 fluid ounces of ether from a large retort into a cooled receiver. The ether is then rectified. In this state, however, it is said still to contain some alcohol, which prevents it dissolving caoutchouc, and this must be separated by washing. This is done by adding about nine or ten fluid ounces of distilled water to the ether, and shaking them well together in a close vessel. They must then be allowed to remain for some time at rest, when the water will subside to the bottom, and the ether remain floating on the top. Pour it off and it is fit for the use of our Correspondent; but he must be careful to keep it in a close stopped vessel. He will, however, find that this is an expensive method; and a cheap one of accomplishing that which he inquires after, has long been a desideratum. Whether or not Mr. T. Hancock's method, mentioned in No. XIX. of the Chemist, be a cheap one we cannot decide.

METHOD OF PREPARING OXYGENATED MATCHES.

Three parts of chlorate of potash and one of sulphur, reduced to powder separately, (for if pulverized together they will detonate) are to be mixed on paper, and care must be taken even in the mixing not to produce any friction or percussion. A small quantity of gum water is added to give consistency to the substance; and also a small quantity of *lycopode*, or wolfs-claw moss, to promote the combustion. It is coloured red with cinnabar, and blue with indigo. The matches are made round, very fine, and are dried in an oven or stove; and one of their ends only is covered with a small quantity of the above mixture. To dry them, the other end is stuck in a box filled with earth or sand. To procure an instantaneous light with these matches, which are now sold at every chemist's shop in the metropolis, it is only necessary to plunge the end into concentrated sulphuric acid, and immediately withdraw it. The sulphur, previous to mixing, should be washed to free it from sulphuric acid, and well dried.

TO PREPARE ALOES PILLS WITH MYRRH.

PILLULÆ ALOES CUM MYRRHA.

This preparation being an excellent cathartic, and much in use under the name of *pilluæ rufi*, we shall give the mode of preparing them from the Pharmacopœia. Take of extract of spiked aloe, two ounces; of saffron and myrrh, each an ounce; and of simple syrup, a sufficient quantity. Rub the extract and the myrrh separately to powder, then beat the whole together, till the mass is uniform. It is taken in doses of ten to twenty grains, both as a stimulant and cathartic.

TO PREPARE PURE CARBON.

Take the whitest sugar which can be procured, and of the finest crystals; dissolve it in water, and again crystallize it by evaporation, at a temperature scarcely higher than that of the atmosphere; distil the sugar thus crystallized by a red heat. There will first come over a fluid resembling water, which is afterwards mixed with pyromucuous acid and empyreumatic oil, and a bulky charcoal remains in the retort. When these matters have done coming over, increase the heat to a point that would melt steel, and keep the charcoal exposed to it for about an hour. It will then be found very brilliant, hard, and difficult to burn. If the operation has been well performed, the charcoal will grow red when exposed to heat, without producing the smallest flame, and as soon as it is withdrawn from the furnace it is extinguished. A current of air, also, will extinguish it, and it can only be consumed by oxygen gas, and if this is withdrawn, it becomes immediately black.

QUERY.

The best mode of preparing the different colours which are exposed in the windows of many of the surgeons and chemists.

I remain, R.S.F.

ANSWERS TO QUERIES.

To the Editor of the Chemist.

Sir,—Your correspondent, "A Constant Reader," in No. 18, has two very strangely united questions. What has tallow to do with onions, Sir? Is he some gentleman who wants to set up a shop for making savoury soups for the poor in winter? I see no other possible application of fat and onions, and confess I am much surprised how any head conceived the two things together, or how you, Mr. Editor, came to admit such an absurd mixture into your pages. I would answer your correspondent's questions if I knew how; but I have never heard or read of the juice of onions being prepared or concentrated. I know experiments have been made to analyse this vegetable, but as the roots themselves keep from year to year, from harvest to harvest, and are sent many thousand miles, nobody but your correspondent has ever thought of expressing the juice, and concentrating it for preservation. As to your correspondent's second query, Sir, I must observe that *fat* is a general name for several kinds of solid oily substances found in animals, while tallow is the name of a particular species of fat. What he means by the best kind of tallow, I am at a loss to know. Does he mean the best tallow for candles; or the best suet for puddings? If he is explicit as to what he means, I am sure the pages of the Chemist will supply him with an answer; but, as his query at present stands, it cannot be answered. Wishing you more discretion, Mr. Editor, than to admit such communications, and your correspondent more precision,

I remain, yours,

Castigator.

Tower, July 15.

Mr. Editor,—In a reply to a query in your 19th No. as to a cement or putty which is not attacked by sulphuric acid, I beg leave to refer the querist to No. 2 of your own work, page 19. The lute, Sir, there recommended, called the *fat lute*, resists the action of sulphuric acid, and is employed on a large scale in the muriatic acid manufactory, and in operations where sulphuric acid is used, to lute vessels. It answers perfectly well. I am, Sir,

Your obedient Servant, T. S.

London, 31 *July* 1824.

Mr. Editor,—I observe in a late Number of the Chemist an article on Mr. Perkins' invention of a steam gun, and being quite a novice in the valuable science of which you are a patron, I make free to ask a question or two in explanation. It is stated in the above named article, that, at the pressure of forty atmospheres, a ball is expelled from a gun with velocity equal to a field charge of powder, and that, at forty-five atmospheres' pressure, a ball strikes the target with force sufficient to liquefy the lead. Now, I understand, that heat alone can change metal from a solid to a liquid state, and will you be kind enough to inform me by what process in this experiment the lead is heated to so great a degree as to cause liquefaction. Is it by the heat of the gun-barrel caused by the steam,—the velocity with which it passes through the air,—or the resistance afforded by the target? Your kindness, in attending to these (perhaps ucscientific) queries, will be duly appreciated by, Sir,

Your admirer, R. C.

All these circumstances contribute to the effect, but it is chiefly due to the last. Air, when suddenly compressed, as is well known, gives out so much heat as to set tinder on fire; and it is the compression of the lead that melts it. It is well known that lead, as well as iron, may be *heated* by being hammered, and the force of striking against the target is only a more vigorous hammering. Ed.

CHEMICAL SOCIETY.

To the Editor of the Chemist.

55, Great Prescot-street,
Goodman's-fields.

SIR,—I beg leave to inform you, that at a former Meeting of the friends of the Chemical Society, a Committee was appointed, for the purpose of framing the laws and regulations, which being now completed, they avail themselves of your polite offer to make their proceedings public, through the medium of your useful and valuable Periodical; and to inform those gentlemen who may wish to become the founders, that a Meeting will take place here on August 12th, his majesty's birthday, for the purpose of electing and installing the officers, and establishing the Society.

Gentlemen who may be inclined to attend, are requested (if convenient) to send their names and addresses to me, on or before the 11th instant.

I am, Sir,
Your most obedient servant,
W. JONES,
Sec. Pro. Tem.

NATURAL HISTORY.

M. CUVIER lately presented a Report to the Academy of Sciences on the state of natural history, and the increase of our knowledge in that department since the return of maritime peace, the details of which are very curious. In 1778, Linnæus indicated about 8000 species of plants; M. Decandolle now describes 40,000; and in a short time they may probably exceed 50,000. Buffon estimated the number of quadrupeds at about 300; M. Desmarets has just enumerated above 700, and he is far from considering the list complete. M. de Lacepede wrote, twenty years ago, the history of all the known species of fish: the whole did not amount to 1500; the cabinet of the king alone has now above 2500, which is only a small proportion, says M. Cuvier, of what the seas and rivers can furnish. We no longer venture to fix the number of birds and reptiles; the museums are crowded with new species, which require to be classed. Above all, we are confounded at the continually increasing number of insects; it is by thousands that travellers bring them from hot climates: the Royal Museum at Paris contains above 25,000 species, and there are at least as many more in the various cabinets of Europe. The work of M. Strauss, on the Maybug, shows, that this insect, an inch in length, consists of 306 hard pieces, serving as shells or envelopes, 494 muscles, 24 pair of nerves, and 48 pair of tracheæ.

TO PURIFY CORN SPIRIT.

M. ZEIZE has announced to the world, that a small quantity of chloride of calcium (oxymuriate of lime) moistened with water, added to the wash made from potatoes or grain, the liquid being allowed to subside before it is distilled, makes the spirit which results more like brandy. It is freed from the peculiar taste all corn brandies have, and is quite as good as that made from wine. The chloride must be good; and the only way to ascertain the quantity which ought to be employed, is to try with a small portion of the wash.

TO CORRESPONDENTS.

Electricus *in our next.*

We are unable to form a precise opinion on the subject mentioned by R. Fuller, but we are sure there is demand enough for chemical apparatus to pay those well who are disposed to sell reasonably. Success will, however, depend on personal activity.

Problematicus *has been received; his valuable communication shall be inserted in our next.*

*** *Communications (post paid) to be addressed to the Editor, at the Publishers'.*

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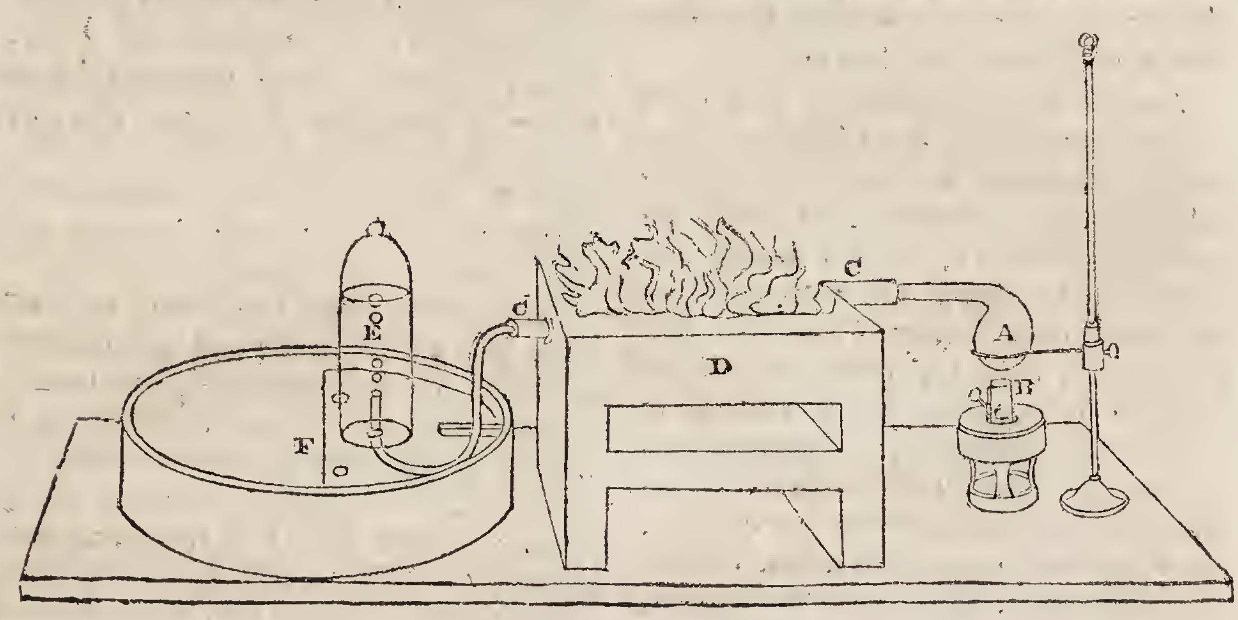
The Chemist.

"—— Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if nought in these external scenes
Can move thy wonder?——"

No. XXIII.] SATURDAY, AUGUST 14, 1824. [Price 3*d*.



CONTENTS.

TO DECOMPOSE WATER.

(*From a Correspondent.*)

Mr. Editor,—Having observed that, in No. XIV. of the Chemist, a Correspondent inquires after a means for the decomposition of water, I take the liberty of transmitting you two methods: one is, to decompose it by means of carbon, and the other by galvanism. First, to decompose it by carbon. Let your Correspondent provide himself with a glass retort, A, to contain water, which he may heat by the lamp, B, or by any other means he pleases; also with a porcelain tube, C C, an open furnace, D, a little pneumatic trough, F, and a receiver, E, to collect the gas. He must put some charcoal in small pieces into the tube, so as nearly to fill it, then place this in the furnace, where it must be subjected to a good heat. The retort must be adapted to one end of the tube, and a bent tube at

the other end to convey the gas into the receiver. On making the water boil, the steam or vapour passes over and through the charcoal, which when red hot will separate the oxygen of the vapour from the hydrogen. The gas, however, which will pass into the receiver, is not pure hydrogen, but contains a quantity of carbonic acid gas, resulting from the union of the carbon with the oxygen, and is called carbonated hydrogen gas. The other method of decomposing water, by galvanism, is the most convenient for obtaining the two gases separate and pure.

As our Correspondent has sent us another little drawing with his second method, we must postpone it till another Number. It may be useful, however, if we point the attention of the reader to one inference to be drawn from this experiment: this is, that in consequence of carbon at a red heat decomposing water, a small quantity of this fluid, particularly when scattered in drops from an engine, may promote combustion rather than retard it. If it be decomposed, it will give oxygen to the flame, which only makes the conflagration more rapid. To extinguish fire, therefore, either a large quantity of water should be thrown, or some other means taken to exclude the air, and reduce the temperature below the burning point.—Ed.

CHEMISTRY AS A SCIENCE.
Art. XXII.

CHROMIUM. MOLYBDENUM. TUNGSTEN. TELLURIUM. COLUMBIUM. TITANIUM. SELENIUM. OSMIUM.

There is found, though in small quantities, at the mine of Beresof, in Siberia, a mineral of a beautiful red colour, with a shade of yellow. It is called the red lead of Siberia, and was used as a paint. In 1797, this mineral was examined by M. Vauquelin, the French Chemist, and found to contain a peculiar acid, till then unknown, with a metallic base. His experiments have since been frequently repeated, and the base of this acid reduced to a metallic state, by heating it with charcoal. This metal was called *chromium*. It is very brittle, of a greyish-white colour, intermediate between steel and tin. It is very slightly magnetic, and, for a metal, is very light. It requires a powerful heat to melt it, and is only slowly acted on by aqua regia. It has only been obtained in small quantities by a few eminent chemists, and for the purposes of examination. Nothing more is known of it, and it has been put to no use. Chromium, however, is the colouring material of a number of beautiful minerals. The one we have already mentioned is an ore of lead, and the emerald owes its colour to the oxide of chromium, while the *spinelle ruby* derives its tint from chromic acid.

In Sweden, and in other parts of Europe, there is found a mineral somewhat resembling plumbago, though of a lighter colour, and which was long confounded with it. Scheele, however, observed that it was a different substance, possessed of different properties, and thus taught chemists to distinguish them. Plumbago has been already described, and to the other he gave the name of *molybdena*. This mineral, on being analyzed, was found to consist of sulphur and a peculiar acid, having a metal for its base. The acid is now called the molybdic, and the metal obtained from it *molybdenum*. In consequence, however, of the difficulty of obtaining it, hitherto it has been procured only in small quantities, and has been put to no use. In fact, by no art has it been found possible to obtain it in any other form than small grains, so that its properties are very imperfectly known. With some other metals it unites readily, and forms brittle alloys. Its colour, even, has not been settled, though this has been the object of numerous and laborious experiments. As the ore, however, may be easily obtained, that industry and skill which have already converted so many apparently useless

and even pernicious substances to valuable purposes, may also find a cheap and easy method of obtaining molybdenum from its ore; and if it be a peculiar metal, possessing distinct properties, will undoubtedly know how to apply it to some useful purpose.

The metal called *tungsten*, like chromium and molybdenum, can hardly be described as known, or even as positively existing. There is found in Sweden a heavy mineral, called, from its great weight, *tungsten*, or ponderous stone; it is white and opaque; there is also found in tin mines a brownish black mineral, called *wolfram*. Both these minerals, on being subjected to analysis at different periods, and by different celebrated chemists, were found to contain a peculiar acid, to which Scheele, who first discovered it, gave the name of *tungstic acid*. On being exposed to a strong heat, with charcoal, this acid is decomposed, and a metal is obtained, which has been called *tungsten*, *tungstenum*, and *wolframium*. It is said to have a greyish-white colour, like that of steel. It is very hard, being scarcely scratched by a file, and nearly as heavy as gold. As a metal, nothing more is known of it; but it is said that it is employed in France to precipitate the colouring matter of certain woods, so that this can be collected and formed into cakes, which are used by painters.

In the mine of Mariahilf, near Zalethna, in Transylvania, an ore is found of a bluish-white colour, and of a metallic lustre. In 1782, a Mr. Muller, of Reichenstein, concluded, from his experiments on this ore, that it contained a metal different from every other. His opinion has been subsequently confirmed by the experiments of several chemists, and to this metal the name of *sylvanite* was given. It is now called *tellurium*. Its colour is bluish-white, intermediate between zinc and lead; it is laminated like antimony, and is very brilliant. It is comparatively light, and so brittle that it may be reduced to powder. It requires a little greater heat than lead to melt it. It may be boiled and evaporated, and is next to mercury and arsenic in the scale of volatility. Its combination with oxygen possesses acid properties. This metal has been the subject of considerable research; it has been united with chlorine, hydrogen, and other substances, but only small quantities of it have ever been obtained for experiment, and neither it nor its compounds have ever been put to any use.

There is something a little curious connected with the discovery of columbium. In 1801, while Mr. Hatchett was arranging some minerals at the British Museum, one of them, a dark coloured, heavy substance, attracted his attention, on account of its resemblance to *chromate of iron*. It was stated to have come from Massachusetts, in North America, and was described as a heavy black stone, with golden streaks. Mr. Hatchett analyzed this mineral, and found it composed of oxide of iron and a white substance, possessing the properties of an acid. The acid had a metallic base, and, exhibiting peculiar properties, he gave it the name columbium. Soon after this period, a Swedish chemist, Mr. Ekeberg, detecting a metal different from every other with which he was acquainted, gave it the name of *tantalum;* but in 1809, Dr. Wollaston, having procured specimens of the mineral from which Mr. Ekeberg had obtained his metal, proved that the *tantalum* of this chemist and the *columbium* of Mr. Hatchett were the same substance. It has since been more than once examined, and the metal found to be of a dark grey colour, having somewhat the appearance of iron. It is so hard as to scratch glass, and is affected by none of the acids.

In the valley of Menachan, in Cornwall, there is found a black sand, resembling gunpowder in its appearance. In 1791, Mr. Gregor analyzed this, and found it to contain a new metal, to which he gave the name of *menachine*. Mr. Klaproth, a Prussian chemist, of much

greater celebrity, afterwards discovered the same substance in a mineral called red shorl. He called it titanium, and this name is now adopted. M. Laugier describes it as of a yellow colour, having considerable lustre and elasticity, and as being very difficult to fuse. It is considered a very intractable substance, and nothing more of the least importance has been learnt concerning it.

A substance to which Berzelius has given the name of *selenium*, has been obtained by him from the residuum of some iron pyrites, which are made use of at Fahlun, in Sweden, to obtain sulphuric acid. It is a brown substance, with a metallic lustre; is easily melted, and then remains for a long time in a soft state, so that it may be kneaded, and even drawn into threads. High authority places it among the metals simply on account of its lustre, but this can scarcely be sufficient reason; and if, after being more closely examined, it should be found to be a peculiar undecompoundable substance, it will most probably be classified under some other head. It first excited curiosity, and is still distinguished, by emitting a smell resembling that of horse-radish.

Osmium is the other metal which Mr. Tennant discovered when he was making his experiments on the ores of platinum, which have been already mentioned in speaking of *palladium* and *iridium*. Its oxide gives out a certain smell resembling the odour of chlorine. The *metal*, if it deserves the name, is of a dark grey or blue colour, and evaporates with the above smell in the open air when heated. When kept in close vessels, so that its oxidizement is prevented, it does not appear volatile; and when subjected to a strong heat underwent no apparent alteration. This substance has only been obtained in very minute quantities, and its properties are yet very imperfectly known.

DICTIONARY OF CHEMISTRY.

Bleaching Powder, *bleaching salt, chloride of lime.*

Blende. An ore of zinc.

Blood always separates into two masses, one a thick substance, called crassamentum, or cruor, and the other called serum, the latter being in general in proportion of 3 to 1 of the former. 1000 parts of serum of human blood are said to consist of 905 water, 80 albumen, 6 muriate of soda and potash, 4 lactate of soda with animal matter, and 4.1 of soda and phosphate of soda with animal matter. The cruor consists of 64 colouring matter, and 36 fibrina in 100.

Blood Stone. A species of calcedony has this name.

Blow-pipe. A well-known instrument, of which there are several kinds. Formerly it was only used by the brazier or goldsmith; now it is one of the most useful instruments possessed by the chemist.

Blue Carbonate of Copper, *mountain blue, blue calyx of copper.* An ore of copper, frequently met with in Britain.

Blue Iron Earth, *native Prussian blue.* An iron ore, containing a considerable quantity of phosphoric acid.

Blue, Prussian, consists of oxide of iron and ferro-prussic acid.

Blue Saxon. Indigo and sulphuric acid; some persons add potash.

Boletates. Salts composed of a base and boletic acid.

Boletic Acid. A vegetable acid, discovered by M. Braconnot in 1811, of which little is known.

Boletus. The species of mushrooms in which it was detected.

Bologna Stone, *bolognian stone, ponderous stone, native sulphate of barytes.* A phosphoric stone.

Bones owe their strength to the presence of phosphate of lime, which is kept united into a mass by animal gelatine. When calcined, human bones consist of, in 100 parts, 81.9, phosphate of lime, 3 fluate of lime, 10 lime, 1.1 phos-

phate of magnesia, 2 soda, 2 carbonic acid. Before calcination they probably contain about the half of their weight of gelatine, but the proportions vary.

BORACIC ACID. The acid found in borax. It is also found on the edges of some hot springs near Sapo, in the Florentine dominions.

BORACITE, *borate of magnesia.*

BORATES. Salts formed with boracic acid and a base.

BORAX, *borate of soda*, consists of 36 boracic acid, soda 17, water 47. It is well known as an excellent flux, and is employed in many arts.

BORON. The elementary base of boracic acid. A simple substance.

BOTANY BAY RESIN exudes spontaneously from a tree in New Holland.

BOULDERS, *boulder stones.* Rolled blocks of granite, found in several parts of Europe at a great distance from any granite mountains. To account for their existence in such places has given birth to several geological theories.

DISTILLATION.

Art. I.

WE mean, in a series of papers under this title, to present our readers with a short account of the principles and of the practice of distillation, more particularly, however, of that part which is usually understood by the term, or the manufacture of ardent spirits. It is a well established fact, that almost all substances require a different quantity of heat to make them assume the form of vapour, and consequently when any compound substance consists of ingredients that are volatilized by different quantities of heat, we are able to separate them from one another. We have already given several examples of this. The mode in which mercury is separated from gold and silver is one in point; and this separation is effected by the mercury passing over in vapour at 650° Fahrenheit, while the other metals will not, at that temperature, assume a liquid form. If the substance which remains be the most precious, and if the process is undertaken only for its sake, it is called purification; if, on the other hand, it is the substance which flies off earliest which is most precious, and it is for its sake that the process is undertaken, it is called distillation. Thus, when water impregnated with carbonic acid gas and air is made to boil, the whole of the carbonic acid gas and air are made to pass off, and the water is said to be purified; but if, after the carbonic acid is expelled, the process is continued, and the steam or vapour of water, as it rises, is again condensed and preserved, this water is said to be distilled, and the process is called distillation. This theory, or rather definition, of distillation supposes, how truly we will not decide, that the products of distillation all pre-existed in the compound substance subjected to the action of the fire, and that no new substance is generated by this action. Thus Messrs. Brande and Gay Lussac have both proved, by very decisive experiments, that brandy or alcohol exists, ready formed, in all wines; and they have pointed out a method by which it can be separated, by means of chemical affinities, in as pure a state as if it had been distilled. We do not ourselves go the whole length of this theory; and we suppose there are many cases, that, for example, of the distillation of pyrolignous acid, in which the action of heat in the close still first disposes the elementary substances to take a new form, or a new combination, and then expels the new formed substance. This distinction should certainly not be overlooked in practice. When the substance to be obtained exists ready formed, we have only to attend to the means of most completely separating it. When it does not exist ready formed, it is plain there is another important matter demanding attention.

The principle is the same, whether the substance on which we are to operate be solid, as wood and bones, or liquid, like wort or wine; or whether the substance we are to

obtain be a fluid, like brandy, or a solid, like sulphur. In the former case a different kind of still is only necessary: in the latter the condensing apparatus must be very different. If the substance to be obtained condenses into the solid form, like corrosive sublimate or sulphur, nothing more seems necessary than to convey the vapour into a vessel where it is deposited. In such cases, too, the vapour adheres to the upper part of the still or alembic in which the process is carried on, and then it is called not distillation, but sublimation. It is more common, however, to place another vessel inverted over the still, for the reception of the sublimated products, or, as in the manufacture of sulphur, to convey the vapour into a room constructed for the purpose. The substance is then condensed on the inside of the vessel or room, and is scraped off, or removed in the form of a cake; and in this way several chemical products in common use are obtained. If the vapour condenses into a liquid, the condensing part of the process is the most important; and instead of a vessel simply inverted over the still, a more complicated apparatus is necessary. The nature of this depends in some measure on the circumstance, whether the vapour is to be speedily or slowly condensed. Generally it is desirable to condense it speedily; it saves time, which is a saving of expense; it saves space, and it also saves the cost of a long line of condensing tubs, or other apparatus. As the first part of the process consists in making the substance it is desired to obtain separate, by means of heat, from other substances, in the form of vapour; so the second part of the process consists in again abstracting this heat, and reducing the desired substance to the form of a liquid or a solid. The natural tendency there is in heat equally to distribute itself in all bodies, insures us an easy means of abstracting the heat from the vapour, by merely allowing the vessels in which it is contained to be freely exposed to the contact of air. This does not, however, work quick enough for man, and he hastens the condensing process by a variety of methods, but chiefly by the application of cold water. It would be an almost endless task for us to describe every one of these methods. It seems that we have done sufficient in stating the principles; and are quite sure that our intelligent readers will know how to apply them. Generally we may observe, that the condensing part of the process has not been so much improved as the vaporizing part. We believe, for example, the combined effects of both air and water are not efficaciously brought into action. Thus, in general, the cooling agency of water is only applied, as in the apparatus for condensing pyrolignous acid, and, as in the tubs which surround distillers' worms, excluded from the cooling agency of renewed currents of air. In many parts of Europe, spontaneous evaporation, by spreading salt water over a large surface, is employed to concentrate the water, which produces a considerable degree of cold; and we do not see why some similar process should not be adopted by the distiller; why, for example, the surface of the condensing apparatus, or of the worm, should not be exposed to a current of air, while it is also kept constantly wet, by water dripping on it, or running over it.

From this outline of the principles of distillation, it will be evident to our readers, that it is a very general process, subject, indeed, to many subordinate details. It is probably, also, a very ancient art, for it is taught man by nature, whenever he will open his senses to her instruction. The sun during the day separates water from the surface of the earth, and spreads it as vapour through the atmosphere; as his heating powers are diminished, this vapour condenses of itself, and again separates from the air in the form of dew. This is a perfect species of distillation, and dew, unless contaminated by

that on which it falls, is found to be *pure* or distilled water. For many purposes this distilling power of the sun is taken advantage of in the arts, and a process called distilling by the sun is still carried on in warm climates. With this example of nature under their eyes, we have reason to believe men would not be very long before they began to imitate it; and accordingly, distilling, in the enlarged sense of the word, is a very ancient art, and is now very generally known. At least, men were acquainted with it wherever the civilization of the ancient world reached, and now are wherever civilization is diffused. The distillation of ardent spirits, indeed, is said not to have been known in Europe till towards the year 1150, when it was introduced into Spain by the Moors. Although the Greeks and the Romans knew some distilling processes, there is no evidence that they were acquainted with what we more particularly call distillation.* But at present, from that part of Asia where man and the arts are both supposed to have had their origin, to the most northern point of Europe, hence to the most southern cape of Africa, and throughout the vast continent of America, the knowledge of distillation has been spread, and the art is now practised. We believe, after cultivating the ground, building habitations, and making clothes, distillation is the most generally practised of all the useful arts, and exists as a trade where the art of making leavened bread is yet unknown. We are quite persuaded, that vices and miseries are, if we may so speak, only exceptions to the great system of nature, and whatever is general, or almost universal, cannot be evil. Should the surly moralist reproach distillation with the excesses sometimes committed by its aid, we will point his attention to the beneficial effects of ardent spirits in enabling the constitution of man to resist the noxious effect of marsh miasma. Without them it may be doubted if he could ever have drained the marshes of Holland, now a memorial of human skill and human power, far more ennobling than the pyramids of Egypt; or ever have cleared the woods and savannahs of America, which promise, as greater freedom seems there destined to raise up a more powerful community than the world has ever yet seen, hereafter to exhibit something which shall far surpass both the dykes of the republican Dutchmen, and the tombs of the Egyptian kings. If any morose cynic should still think these memorials, and these triumphs, and the sparkling joys of incipient intoxication, mere trifles compared to the evils of inebriety, we should still say he took only an imperfect view of the great process of distillation; and we would ask him how he could possibly condemn that for which he is indebted for dew and rain in nature, and for so many things in art that we are at a loss which to select as the most useful and valuable.

* See Anderson's History of Commerce, vol. i. p. 83.

As in Great Britain little or no spirits is distilled without one portion of the grain having first been malted, we shall in our next paper on this subject describe the process of malting.

ANIMAL HEAT.

To the Editor of the Chemist.

SIR,—It occurred to me, in reading in No. XXI. the Article on Animal Heat, that the theories hitherto started are by no means irreconcileable; and that the opinions of Edwards and Brodie are only two different views taken of the same fact from opposite points, but are themselves equally correct. Admit with Edwards that oxygen is, in the process of respiration, absorbed by the arterial blood, of which one of the component parts is carbon, it does not follow that a decomposition of the venous blood, by the separation of part of its

carbon, and a new combination of that separated part with the oxygen, must necessarily be formed by means of the simple admixture alone. Some more powerful agent appears necessary to effect this; and such an agent is no doubt supplied by the nervous energy, whatever that may be, and therefore, agreeably to Mr. Brodie's theory, by the mind.* That this nervous energy is the agent of digestion in the stomach, has been proved by Dr. Wilson Philip, who has also ascertained that its want may be supplied in that particular by electricity. How far the nervous functions are or not electrical is a matter of very curious and important speculation, in the investigation of which too few facts are as yet ascertained for the forming of any solid opinion: but as it seems to be so in the process of digestion, it is highly probable the same may be the agent in producing animal heat. One fact, which appears to have a relation to this subject, and to show some such connexion, is this: blood, when drawn from the veins or arteries, under whatever circumstances or condition, cannot be prevented from coagulation; and for that reason its fluidity has been supposed by many to be owing to the animal life which the blood itself possessed. The blood is also found coagulated in the veins after death: but in many cases, where the bodies of persons killed by lightning have been examined, the blood has been found still fluid; from which we might fairly imagine, that the fluidity of the blood was occasioned by nervous electricity, and on that being cut off, its place had, in the instances above mentioned, been supplied by the electricity of the atmosphere.

A. Z.

* We are not exactly of the same opinion with our Correspondent. We know that the union of carbon with oxygen out of the body gives out *heat*; and the only question is, supposing that union to take place in the body, is it sufficient to account for the production of animal heat? If it is, why should we not rather suppose, that this union in the body is effected by the chemical *properties* of these two substances, than by the aid of some *nervous* energy, of which little or nothing is known, and which has, in fact, already more functions attributed to it than it can well perform. We know that all the phenomena of life cannot be explained on mere chemical principles; but neither is our knowledge of these phenomena increased, by supposing the existence of a nervous energy, which is again supposed to be electricity, which is again supposed by some to be a *fluid*, and by others an agency. The necessity of the nerves to the existence of bodily functions may be inferred, from their having been created, and is known from experience; but *how* they act is yet involved in doubt and darkness. The experiments of Dr. Wilson Philip, to which our Correspondent alludes, were undoubtedly very ingenious; and if our recollection of them is correct, they served to show that nerves, at least those of the stomach, might be considered as instruments, resembling in their operation the Voltaic pile, and that their place might be supplied by a galvanic battery. Should this conjecture, however, be verified, it will show a still closer approximation in the phenomena of life to those of the external world, than is even now supposed.

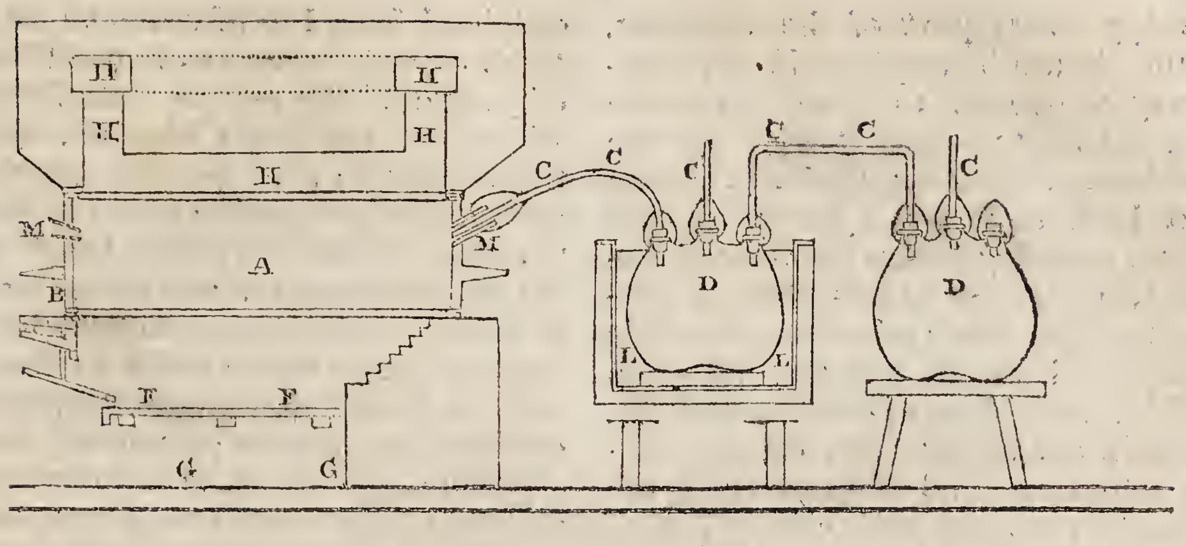
TO MAKE NAMES GROW IN FRUIT.

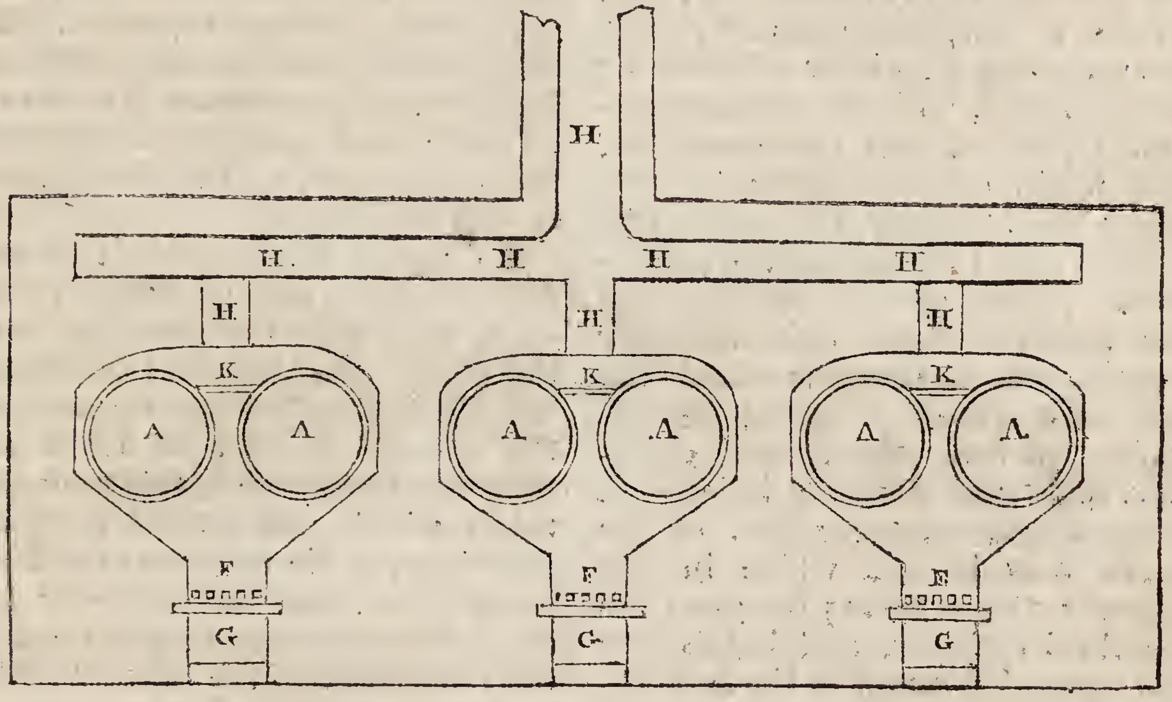
To the Editor of the Chemist.

Mr. Editor, — Perhaps your younger readers may be pleased to learn the following simple method of engraving the names of their beloved in the peaches and nectarines they mean to present them with. Perhaps, too, with some ingenuity, they may get beyond a name, and, making fruit sentimental, at once gratify both the palate and the heart.

A Ci-devant Jeune Homme.

When fruit of the above description is about half ripe, cover the side exposed to the sun with strips or specks of wax, in any desired shape or form, which hinders the sun from colouring the parts covered, and when the fruit is ripe and the wax removed, it will be found marked in the manner desired.





APPARATUS FOR MANUFACTURING MURIATIC AND NITRIC ACIDS, ON A LARGE SCALE.

The former of these acids is obtained by decomposing muriate of soda or sea salt, by means of sulphuric acid. Five parts by weight of strong sulphuric acid are added to six of dried sea salt. The sulphuric acid combines with the alkali, and expels the muriatic acid, which is rapidly absorbed, and condensed by water. Nitric acid is obtained by decomposing nitrate of potash, or saltpetre. Three parts of saltpetre, coarsely powdered, are put into a retort, to which two parts of strong sulphuric acid are carefully added, which separates nitric acid from the potash, as in the former case it separated muriatic acid from the soda. As the principles of these operations are the same, the same form of apparatus serves for both, and that is now to be described.

A furnace is constructed capable of containing twenty cylinders, a side view of one, A, in its place, is given in Fig. 1. They are made of cast iron, of a homogeneous texture and uniform thickness, in order to prevent unequal expansion and cracks. They are placed in pairs in the furnace, and each pair has its fire-place, as seen in Fig. 2, an end view, and somewhat like the apparatus for making coal gas. Every part of the cylinder should be equally heated, in order that the decomposition of the salt may be simultaneous and the iron be as little as possible injured by the acid. In proportion as the sulphuric acid contains little water, and in proportion as the cylinder is heated, it is less subject to be injured by the acid. The flame should en-

velop every part of the cylinder, and should be retained in the archway above it, to give out some of its heat before it flies up the chimney. Each cylinder is closed at both ends by a plate of cast iron entering just within the cylinder, where it meets with a circular rim. Each plate has a handle of cast iron, B, and a small tube, MM, projecting upwards, and being in the upper part, for the purpose at one end of pouring in the sulphuric acid, and conveying off the product at the other. The first cylinder communicates by the curved tube, C, either of glass or earthenware, with the earthen vessel, D, which has three mouths, and again communicates by two other bent tubes, CC, with two other vessels of the same description. All the gas not condensed in the first D, passes into the other vessel, and at the same time the second vessel D receives the gas extracted from the second cylinder, and transmits what it does not condense to another vessel of the same description, which in like manner also receives the gas from the third cylinder, and in this way the process goes on to the last vessel, which receives the gas not condensed in all the others, and, moreover, that which issues from the last cylinder. From this, whatever is not condensed is again transmitted through a second range of bottles, consisting, perhaps, of 20, till the whole is condensed. It is proper to place the first range of bottles in a trough, LL, through which a stream of water flows gently and constantly, cooling the bottles, and getting itself heated. The purest muriatic acid is obtained in the second range of bottles. That which is condensed in the first series always contains a little sulphuric acid, and sometimes sulphate of soda and muriate of iron. All these bottles are to be half filled with water, which will absorb 2-5ths of its weight of muriatic acid. It is neither difficult nor expensive to erect this apparatus, and by its means 130 parts of muriatic acid, of the specific gravity 1.190, may be obtained from 100 of common salt. Each cylinder receives about 2lbs. of salt, and the end is then luted with clay, the fire is kindled, and the sulphuric acid poured on the salt, in the proportion of 80 to 100 if the acid is concentrated to 66° of Baume's areometer, and 83 to 100 if it is only concentrated to 64°. The fire should be made brisk at first, and be lessened immediately the distillation begins; when this slackens, the heat is increased; afterwards the end is removed, the sulphate of soda taken out, and the process is then repeated. By means of syphons the muriatic acid is drawn into bottles or jars covered with basketing, its strength is 23° of Baume, and in this state it is sent to market.

To make nitric acid it is not customary to use so many cylinders, otherwise the processes are the same. To 100 parts of nitrate of potash, 60 of sulphuric acid, of the specific gravity of 1.845 are added. For making this acid, the tubes which communicate immediately with the cylinders ought to be of glass, that the colour of the acid which passes may be seen; the remainder of the tubes may be of earthenware. Some parts of the plate are yet to be described. E is the door of the fire-place; F the bars; G the cinder-hole; H chimney; K is a piece of cast iron connecting each pair of cylinders in their whole length; L the cooler or trough in which the first series of bottles are placed.

ON THE CORROSION OF COPPER SHEETING.

By Sir Humphrey Davy.

1. The rapid decay of the copper sheeting of his majesty's ships of war, and the uncertainty of the time of its duration, have long attracted the attention of those persons most concerned in the naval interests of the country. Having had my inquiries directed to this important object by the commissioners of the Navy Board, and a committee of the Royal Society having been appointed to consider

of it, I entered into an experimental investigation of the causes of the action of sea water upon copper. In pursuing this investigation, I have ascertained many facts which I think not unworthy of the Royal Society, as they promise to illustrate some obscure parts of electro-chemical science; and likewise seem to offer important practical applications.

2. It has been generally supposed, that sea water had little or no action on pure copper, and that the rapid decay of the copper on certain ships was owing to its impurity. On trying, however, the action of sea water upon two specimens of copper, sent by John Vivian, Esq. to Mr. Faraday for analysis, I found the specimen which appeared absolutely pure, was acted upon even more rapidly than the specimen which contained alloy; and, on pursuing the inquiry with specimens of various kinds of copper which had been collected by the Navy Board, and sent to the Royal Society, and some of which had been considered as remarkable for their durability, and others for their rapid decay, I found that they offered very inconsiderable differences only in their action upon sea water, and consequently the changes they had undergone must have depended upon other causes than the absolute quality of the metal.

3. To enable persons to understand fully the train of these researches, it will be necessary for me to describe the nature of the chemical changes taking place in the constituents of sea water by the agency of copper.

When a piece of polished copper is suffered to remain in sea water, the first effects observed are, a yellow tarnish upon the copper and a cloudiness in the water, which take place in two or three hours: the hue of the cloudiness is at first white; it gradually becomes green. In less than a day bluish-green precipitate appears in the bottom of the vessel, which constantly accumulates, at the same time that the surface of the copper corrodes, appearing red in the water, and grass-green where it is in contact with air. Gradually carbonate of soda forms upon this grass-green matter; and these changes continue till the water becomes much less saline.

The green precipitate, when examined by the action of solution of ammonia and other tests, appears principally to consist of an insoluble compound of copper (which may be considered as a hydrated sub-muriate) and hydrate of magnesia.

According to the views which I developed fourteen years ago, of the nature of the compounds of chlorine, and which are now generally adopted, it is evident that soda and magnesia cannot appear in sea water by the action of a metal, unless in consequence of an absorption or transfer of oxygen. It was, therefore, necessary for these changes, either that water should be decomposed, or oxygen absorbed from the atmosphere. I found that no hydrogen was disengaged, and consequently no water decomposed: necessarily, the oxygen of the air must have been the agent concerned, which was made evident by many experiments.

Copper in sea water deprived of air, by boiling or exhaustion, and exposed in an exhausted receiver or an atmosphere of hydrogen gas, underwent no change; and an absorption in atmospherical air was shown when copper and sea water were exposed to its agency in close vessels.

4. In the Bakerian Lecture for 1806, I have advanced the hypothesis, that chemical and electrical changes may be identical, or dependent upon the same property of matter; and I have further explained and illustrated this hypothesis, in an elementary work on chemistry, published in 1812. Upon this view, which has been adopted by M. Berzelius, and some other philosophers, I have shown that chemical attractions may be exalted, modified, or destroyed, by changes in the electrical states of

bodies; that substances will only combine when they are in different electrical states; and that, by bringing a body naturally positive artificially into a negative state, its usual powers of combination are altogether destroyed; and it was by an application of this principle, that in 1807 I separated the bases of the alkalies from the oxygen with which they are combined, and preserved them for examination; and decomposed other bodies formerly supposed to be simple.

It was in reasoning upon this general hypothesis likewise, that I was led to the discovery which is the subject of this paper.

Copper is a metal only weakly positive in the electro-chemical scale; and, according to my ideas, it could only act upon sea water when in a positive state, and consequently, if it could be rendered slightly negative, the corroding action of sea water upon it would be null; and whatever might be the differences of the kinds of copper sheeting and their electrical action upon each other, still every effect of chemical action must be prevented, if the whole surface were rendered negative. But how was this to be effected? I at first thought of using a Voltaic battery, but this could be hardly applicable in practice. I next thought of the contact of zinc, tin, or iron; but I was for some time prevented from trying this, by the recollection that the copper in the Voltaic battery, as well as the zinc, is dissolved by the action of diluted nitric acid, and by the fear that too large a mass of oxidable metal would be required to produce decisive results. After reflecting, however, for some time on the slow and weak action of sea water on copper, and the small difference which must exist between their electrical powers; and knowing that a very feeble chemical action would be destroyed by a very feeble electrical force, I resolved to try some experiments on the subject. I began with an extreme case. I rendered sea water slightly acidulous by sulphuric acid, and plunged into it a polished piece of copper, to which a piece of tin was soldered equal to about one-twentieth of the surface of the copper. Examined after three days, the copper remained perfectly clean, whilst the tin was rapidly corroded; no blueness appeared in this liquor, though, in a comparative experiment, when *copper alone* and the same fluid mixture was used, there was a considerable corrosion of the copper, and a distinct blue tint in the liquid.

If one-twentieth part of the surface of tin prevented the action of sea water, rendered slightly acidulous by sulphuric acid, I had no doubt that a much smaller quantity would render the action of sea water, which depended only upon the loosely attached oxygen of common air, perfectly null; and on trying a two-hundredth part of tin, I found *the effect* of its preventing the corrosion of copper perfectly decisive.

5. This general result being obtained, I immediately instituted a number of experiments, in most of which I was assisted by Mr. Faraday, to ascertain all the circumstances connected with the preservation of copper by a more oxidable metal. I found that, whether the tin was placed either in the middle, or at the top, or at the bottom of the sheet of copper, its effects were the same; but, after a week or ten days, it was found that the defensive action of the tin was injured, a coating of sub-muriate having formed, which preserved the tin from the action of the liquid.

With zinc or iron, whether malleable or cast, no such diminution of effect was produced. The zinc occasioned only a white cloud in the sea water, which speedily sunk to the bottom of the vessel in which the experiment was made. The iron occasioned a deep orange precipitate; but after many weeks, not the smallest portion of copper was found in the water, and so far from its surface being corroded, in many parts there was a regenera-

tion of zinc or of iron found upon it.

6. In pursuing these researches, and applying them to every possible form and connexion of sheet copper, the results were of the most satisfactory kind. A piece of zinc as large as a pea, or the point of a small iron nail, were found fully adequate to preserve forty or fifty square inches of copper; and this, wherever it was placed, whether at the top, bottom, or in the middle of the sheet of copper, and whether the copper was straight or bent, or made into coils. And where the connexion between different pieces of copper was completed by wires, or thin filaments of the fortieth or fiftieth of an inch in diameter, the effect was the same; every side, every surface, every particle of the copper remained bright, whilst the iron or the zinc was slowly corroded.

A piece of thick sheet copper, containing on both sides about sixty square inches, was cut in such a manner as to form seven divisions, connected only by the smallest filaments that could be left, and a mass of zinc, of the fifth of an inch in diameter, was soldered to the upper division. The whole was plunged under sea water; the copper remained perfectly polished. The same experiment was made with iron; and now, after a lapse of a month, in both instances, the copper is as bright as when it was first introduced, whilst similar pieces of copper, undefended, in the same sea water, have undergone considerable corrosion, and produced a large quantity of green deposit in the bottom of the vessel.

A piece of iron nail about an inch long was fastened by a piece of copper wire, nearly a foot long, to a mass of sheet copper, containing about forty square inches, and the whole plunged below the surface of sea water; it was found, after a week, that the copper was defended by the iron in the same manner as if it had been in immediate contact.

A piece of copper and a piece of zinc soldered together at one of their extremities, were made to form an arc in two different vessels of sea water; and the two portions of water were connected together by a small mass of tow moistened in the same water: the effect of the preservation of the copper took place in the same manner as if they had been in the same vessel.

As the ocean may be considered, in its relation to the quantity of copper in a ship, as an infinitely extended conductor, I endeavoured to ascertain whether this circumstance would influence the results, by placing two very fine copper wires, one undefended, the other defended by a particle of zinc, in a very large vessel of sea water, which water might be considered to bear the same relation to so minute a portion of metal as the sea to the metallic sheeting of a ship. The result of this experiment was the same as that of all the others, the defended copper underwent no change; the undefended tarnished and deposited a green powder.

Small pieces of zinc were soldered to different parts of a large plate of copper, and the whole plunged in sea water: it was found that the copper was preserved in the same manner as if a single piece had been used.

A small piece of zinc was fastened to the top of a plate of polished copper, and a piece of iron of a much larger size was soldered to the bottom, and the combination placed in sea water. Not only was the copper preserved on both sides, in the same manner as in the other experiments, but even the iron; and after a fortnight, both the polish of the copper and the iron remained unimpaired.

7. I am continuing these researches, and I shall communicate such of them as are connected with new facts to the Royal Society.

The Lords Commissioners of the Admiralty, with their usual zeal for promoting the interests of the navy by the application of science, have given me permission to ascertain the practical value of these results by experiments upon ships'

of war; and there seems every reason to expect (unless causes should interfere, of which our present knowledge gives no indications,) that small quantities of zinc, or, which is much cheaper, of malleable or cast iron, placed in contact with the copper sheeting of ships, which is all in electrical connexion, will entirely prevent its corrosion. And as negative electricity cannot be supposed favourable to animal or vegetable life, and as it occasions the deposition of magnesia, a substance exceedingly noxious to land vegetables, upon the copper surface, and as it must assist in preserving its polish, there is considerable ground for hoping that the same application will keep the bottoms of ships clean, a circumstance of great importance both in trade and naval war.

It will be unnecessary for me to dwell upon the economical results of this discovery, should it be successful in actual practice, or to point out its uses in this great maritime and commercial country.

I might describe other applications of the principles to the preservation of iron, steel, tin, brass, and various useful metals; but I shall reserve this part of the subject for another communication to the Royal Society.—*From the Philosophical Transactions for* 1824. *Part I., just published.*

BORAX.

We understand, by a communication from a Correspondent, that we were mistaken in supposing that this salt is not yet manufactured in England. He assures us, that there are three or four manufactories of borax in London, and that the acid is imported in large quantities. The mode in which we expressed ourselves must, however, satisfy him, that we were at the time not confident on the subject; and that our mistake was a very venial one, since chemical works of high authority, published in 1824, mention borax as still imported from India, and say nothing of its being manufactured in England. We are happy to learn that we are mistaken, and that, in small things as well as great, the zeal and enterprize of our countrymen are equally conspicuous.

TESTS FOR METALS.

To the Editor of the Chemist.

Aug. 4.

Sir,—I have often observed, that the three universal *tests* for metals, viz. tincture of galls, sulphuretted hydrogen, and prussiate of potass, precipitate many of the metals but very imperfectly, and so many of the same colour, that it is often almost impossible to be sure, whether it is one metal or another which is held in solution. Besides this, if one metal resemble another in appearance, and at the same time the precipitates formed by these tests are similar, the difficulty is much augmented. Tin and lead are an instance of this; they both give a white precipitate with prussiate of potass.

Now I have found, that the hydriodate of zinc will precipitate most of the metals, and no two metals resembling each other give the same coloured precipitate with it. Besides, the hydriodate of zinc is prepared in the utmost purity, merely by digesting zinc, iodine, and distilled water together, while it is very difficult to obtain the prussiate of potass perfectly pure; and, if not *pure*, it is liable to give false results.

I should remark, however, that the different acids with which the metals are combined make a material difference in the colours of the precipitates.

Table of Precipitates formed by Metallic Salts with Hydriodate of Zinc.

Muriate of Gold, no precipitate.

Nitrate of Silver, yellowish-white.

Muriate of Platinum, deep brownish-red precipitate, which remains suspended.

Nitrate of Mercury, dirty orange.

Muriate of Arsenic, no precipitate.

Muriate of Tin, no precipitate.

Nitrate of Lead, bright lemon colour.

Muriate of Bismuth, grey.
Muriate of Antimony, black.
Muriate of Nickel, idem.
Muriate of Manganese, no precipitate.
Muriate of Copper, greenish cream-coloured.
Muriate of Tellurium, rhubarb coloured.
Sulphate of Iron, no precipitate.
Sulphate of Tellurium, no precipitate.
Nitrate of Bismuth, chocolate coloured.
Chlorate, or *Oxymuriate of Mercury*, brick-dust coloured.
Acetate of Copper, dirty light olive green.
Nitrate of Nickel, light yellowish-brown.
Sulphate of Zinc, no precipitate.
Muriate of Zinc, no precipitate.
Nitrate of Antimony, on pouring in the test, an orange colour; but on mixing the whole well, a black precipitate.

By giving the above a place in the Chemist, you will much oblige

Your old friend,

PROBLEMATICUS.

RANCID BUTTER.

To the Editor of the Chemist.

SIR,—If you think it worth insertion in the Chemist, the following will be found a simple and effectual mode of preventing the rancidity of butter for several months.

Press and beat all the milk out of the butter, then divide it into separate pounds. Put each pound into a linen cloth moistened with common salt and water, deposit them in a stone jar, and fill it up with the same mixture. Place a slate over the mouth of the jar till the butter is wanted for use.

Call me, if you please,

ANOTHER DAIRYMAID.

June 16.

QUERIES.

To the Editor of the Chemist.

Croydon, Aug. 2.

SIR,—I have now before me a Number of the New Monthly Magazine, from which I copy the following:—

"Professor Meinecke, of Halle, has just succeeded in producing a brilliant illumination by means of electric light, and with the aid of an artificial air inclosed in glass tubes."

If, Sir, either of your Correspondents can inform me how to do the like, and will be so good as to communicate such information inclosed to you, I shall be thankful; and if it answers I will endeavour to make satisfactory remuneration.

I respectfully subscribe myself,

Sir,

Your attentive reader,

ELECTRICICUS.

SIR,—I have a friend, a veterinary surgeon, who informs me that he has employed, for the last six months, sulphuret of copper, given in doses of from three drachms to an ounce and a half, daily, for the cure of the disease termed *glanders*. It is given in solution. One of his patients (a horse or an ass?) in particular, must have taken upwards of fourteen pounds of this substance, and yet, after death, he could not detect the least trace of copper in any of the secretions. It appears to act as a tonic and astringent on the system generally.

The only test that he has employed, is a piece of burnished iron or steel, thinking if there were any copper present, it might be precipitated by the superior affinity of the acid for the steel.

If you, Mr. Editor, or any of your numerous correspondents, can inform me in what manner I can proceed to detect its presence, either in the blood, urine, or fæces, you will much oblige

A constant reader,

London, Aug. 8. W. F.

ANSWER TO QUERY.

WE cannot exactly solve all the difficulties pointed out by Chemicus Ignoramus; but there are two facts, one relative to the muriates, and another in his statement, which will probably enable him to see

his way to a solution. In his third note, which we characterised as more marvellous than the two former, he says, the pasteboard never was wet. But in his second letter, it is mentioned, that not *above one or two crystals formed on the under side of the card*, whence it is evident, that the card must have been wet; and as the dish was at first nearly full, the card, we suppose, was the means of conveying the solution from one dish to the other. There can be no doubt but the outside of the upper dish would appear more or less wet according to the state of the atmosphere, all the muriates having a very great affinity for moisture; and what our Correspondent states in the first letter, of the outside never having been wet, is contradicted by what he states in the second, and must, we should suppose, have arisen from inaccurate observation. The general fact relative to the muriates, to which we have alluded, is very curious, and we shall transcribe it from Mr. Parkes' *Chem. Cat.* page 189:—"The muriates are among the most volatile, and yet are the least decomposable by fire of all the salts." "Muriate of soda (common salt) may be volatilized by heat, *but if the vapour* be collected, it will be found still to be muriate of soda." Our Correspondent must, we should suppose, be quite aware, that it is not possible for the solution to escape from one dish into the other by evaporation. Evaporation would have carried it off into the atmosphere; the solution, therefore, was conveyed from one dish to the other by some mechanical means, and was of course equally salt in both.—Ed.

SULPHURETTED HYDROGEN GAS.

To the Editor of the Chemist.

Sir,—I agree with my friend Cat's-paw as to the effects of sulphuretted hydrogen, and the incorrectness of M. Chaussier's statement. I placed a mouse under a receiver full of this gas, and kept it there for more than three minutes, after which he recovered.

Yours, &c.

Chlorine.

P. S. I hope to send you in a day or two a description of a new alkali, which I have discovered in the senna folia.

TO CORRESPONDENTS.

The letter of W. M. S. *is scarcely fit for publication; we thank him, however, for the information he has afforded us, and have made use of it to rectify the error committed.*

The other communication of Chlorine *in our next. We regret as much as he can do the circumstance of quacks and ignorant people injuring the health of his majesty's subjects by selling them improper drugs; but we cannot agree with him that it is right to call on government to interfere. In this respect, people must help themselves; and the way in which they can easily accomplish this, is by only purchasing of respectable dealers. Individual sharpness and discretion is a better preventive of such evils than the interference of government. We shall be happy to receive the communication he promises us.*

We are obliged to Damon *for defending us against the imputation of* Castigator; *but his letter is too long, and, we must say, too severe for publication. If he will reduce it to about the length of* Castigator's *letter, we will, however, insert it.*

Errata.—*In* The Chemist, No. XXI., *in "Notices to Correspondents," for* Sickenger, *read* Sickengen. *In* No. XXII., *title of first article, for* Manufactory, *read* Manufacture.

*** *Communications (post paid) to be addressed to the Editor at the Publishers'.*

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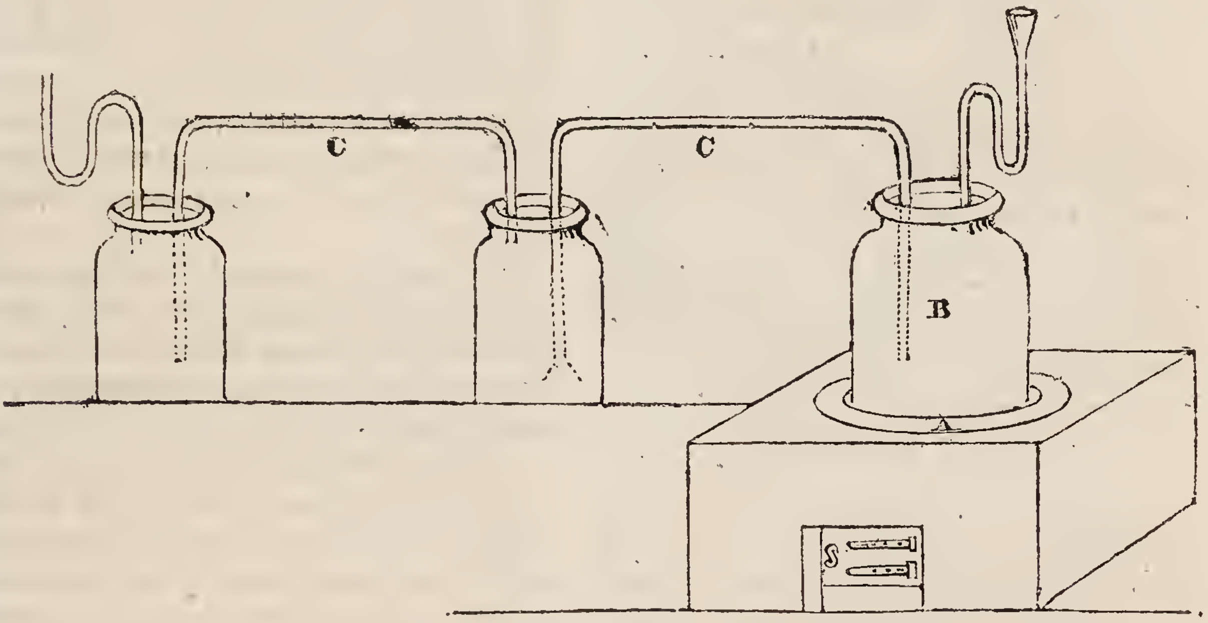
The Chemist.

"——Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if nought in these external scenes
Can move thy wonder?——"

No. XXIV.] SATURDAY, AUGUST 21, 1824. [Price 3*d*.



CONTENTS.

CHLORATE OF POTASH.

SIR,—I observed in Number XX. of The Chemist, a tedious method described of making chlorate of potash, which may be more easily obtained by the following method:—Three jars are to be procured, one of which is to be double the size of the others, and the large one is to answer the purpose of a retort. A solution of potash is to be placed in the two small ones, three quarts in the first jar and one quart in the latter. The retort is to be placed in a sand or water-bath (I prefer the latter,) and one and a half peroxide of manganese, three muriate of soda, and three of water placed in it. The three vessels are all afterwards to be well luted together with a luting of linseed meal; after which is added, very gradually, by the funnel, sulphuric acid. When the chlorine ceases to come over, or begins to come less ra-

pidly, heat is applied to the bath, and chlorine will be again extricated. During the process the solution will appear white and milky, owing to the silica in the potash, which will gradually be precipitated, and the chlorate of potash will be deposited at the bottom and sides of the jar. The fluid (which is excellent bleaching liquid) is to be drained off, and boiling water poured upon the remainder, which is a solution of chlorate of potash, the silica remaining. The solution is to be afterwards evaporated and crystallized. Yours, &c.

CHLORINE.

Explanation.

A, the sand-bath. B, a large jar, much larger than the two smaller ones, to answer the purpose of a retort. C, leaden tubes of communication, which are made larger at the termination, to prevent the accumulation of crystals.

STEAM-ENGINES.

We have for some time past had the intention of endeavouring to give our readers a concise account of the improvements said to have been made in the steam-engine by Mr. Perkins. Before we have been able to execute our intentions, we find it done to our hand in a very able work, which has just fallen under our notice, and from which we shall make some extracts. Its title is, "A DESCRIPTIVE HISTORY OF THE STEAM-ENGINE, by Robert Stuart, Esq.;"* and the object of the book is to give a history of the invention and improvement of steam-engines.

The author, beginning from the earliest notice he can find, of the employment of steam as a moving power, which he traces up to a period before the birth of Christ, has recorded every valuable improvement or considerable alteration which has been made in steam-engines up to the present time. His book is intended, he says, "particularly for the meritorious classes who are engaged in the construction of machinery;" and being enriched with numerous plates, illustrating the progress of the art of making steam-engines, must be of considerable interest to all who live by the mechanic arts, or study them as a branch of general knowledge. Its great merit, as it appears to us, is having brought into a small compass and a cheap form all which is worth knowing of the history of steam-engines. The author has set in a clear point of view the contested claims of different ingenious men, as to having invented or improved different parts of the engine; and, if such a thing were possible, we might expect that even partisans would now cease to dispute on these difficult matters.

We shall at present content ourselves with making the following extract, which we think our readers will find both amusing and instructive:—

"The introduction of the steam-engine into Peru arose from a series of incidents which have almost the air of romance. We have described the high pressure engine of Mr. Richard Trevithick, for which he obtained a patent in 1802. In order to give a better idea of the arrangement and operation of his engine, he had constructed a working model, which was so highly finished that it had found its way to London as a cabinet curiosity.

"About the same period M. François Uvillé had found in Peru some of the richest mines falling into decay, or totally drowned, from the impossibility of draining them by manual labour; and learning also that these mines were considered to be richer in silver ore than those of Mexico, he conceived the idea of introducing the steam-engine as a substitute for animal power, to accomplish their draining. M. Uvillé came to London in 1811; but among those whose opinions he asked, he met with no encouragement to pursue his plan, on account of the inefficacy of steam in an atmosphere so rare as that in

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* One volume 8vo. with forty-seven engravings of different engines.

which the Peruvian mines are situated among the Cordilleras, as well as the seeming impracticability of conveying the parts of those large engines which would be required, over mountains inaccessible to any species of wheel-carriage.

"About to leave England in despair of ever being able to accomplish his grand object, and passing by a street leading from Fitzroy-square, he accidentally saw a model of a steam-engine exposed for sale in the shop of a Mr. Roland. He examined it with great attention; and, being struck with the simplicity and excellence of its principle and construction, he became its purchaser at a price of twenty guineas—this was the Trevithick model.

"M. Uvillé felt he now had in his hands the means, either of carrying forward his gigantic scheme, or of setting the fever of his mind at rest, by demonstrating the impossibility of achieving his project by the medium of the steam-engine. He carried the model to Lima, and lost no time in trying its effects on the highest ridges of Pasco, which form the site of the mines: to his unspeakable joy the experiment succeeded to his most sanguine wish, and to that of some others who witnessed it; and in July 1812, he formed an association with Don Pedro Abadia and Don Jose Arismendi, opulent merchants of Lima, for the purpose of contracting with the proprietors of the flooded mines. The Marquess de Concordia, then Viceroy of Lima, highly approving the plan, under his protection the new company succeeded in getting contracts to work several of the principal mines for the payment of about a fourth part of the produce which they might bring to the surface. These contracts were made in August 1812; and in pursuance of his scheme, M. Uvillé again embarked for Europe, and reaching Jamaica, he took his passage for Falmouth. M. Uvillé's mind was too full of the flattering expectations which his scheme inspired, not to be making frequent inquiries among his fellow passengers about mines and engines. One day conversing with a Mr. Teague, and expressing an anxious wish to find out, if possible, the author of the model he had carried to Lima, he was most agreeably surprised to hear Mr. Teague reply, 'Mr. Trevithick is my near relative, and within a few hours after our arrival at Falmouth I can bring you together.' It happened accordingly; and M. Uvillé resided several months at Camborne with Captain Trevithick, receiving during his stay instructions from that able man in mining and the management and construction of machinery. Accompanied by Capt. Trevithick, he visited other mining districts; and being introduced to Messrs. Bolton and Watt, the first steam engineers in the universe, he explained to these gentlemen the mountainous precipices to be surmounted, and the great elevation of the mines above the level of the sea. But whether the objection of these gentlemen to engage in a speculation in which there was much uncertainty of carrying it forward with effect, either from the disturbed political state of Peru, or the difficulty of transporting the parts, or the great elevation of the situation being adverse to a favourable employment of condensing engines, does not appear; but their opinion was unfavourable to M. Uvillé's project.

"Capt. Trevithick and his friend were not, however, to be discouraged from making the attempt; and in January 1814, the Captain entered into an engagement with M. Uvillé to provide nine engines, at a cost of about ten thousand pounds; which by very great exertions were shipped, with the permission of the British government, from Portsmouth, in the September following, accompanied by M. Uvillé and three Cornish men to direct the erection of the machinery. On arriving safely at Lima, they were welcomed by a royal salute and public rejoicings. But after they had got so far, so

great were the local obstacles in transporting the heavy masses across the mountains, that it was not till the middle of 1816 that they were able to set one of the engines to work. This was the first ever seen in South America, and excited intense curiosity. Great ceremony, it appears, was observed on this important occasion; and the most distinguished honours were conferred on the projectors by the vice-regal government. The official deputation appointed to superintend this new and very extraordinary operation, made a report to the viceroy, which was published in the Lima Gazette, in August 1816. 'Immense and incessant labours,' say the reporters, 'and boundless expense have conquered difficulties hitherto deemed insuperable; and we have, with unlimited admiration, witnessed the erection and astonishing operation of the first steam-engine. It is established in the royal mineral territory of Taüricocha, in the province of Tarma; and we have had the felicity of seeing the drain of the first shaft in the Santa Rosa mine, in the noble district of Pasco. We are ambitious of transmitting to posterity,' they continue, 'the details of an undertaking of such prodigious magnitude, from which we anticipate a torrent of silver that shall fill surrounding nations with astonishment.'

"They then go on to name a number of individuals on whom 'the eternal gratitude of all Spaniards is invoked;' and it is somewhat remarkable, that the only Englishman mentioned by name in this list of worthies is *Mr. Bull*.*

"While these operations were going on in Peru, Captain Trevithick in England was vigorously engaged in providing further supplies of steam-engines, constructing coining apparatus for the Peruvian mint, and in constructing furnaces for purifying silver ore by fusion; a project of incalculable importance from the increasing scarcity of quicksilver. This second supply was sent from England in October 1816, and arrived at Lima in the February following. Capt. Trevithick went out in this vessel. On his arrival he was immediately presented to the viceroy, and most graciously received, and his arrival officially announced in the Lima Gazette. Public notice was at the same time given in this of the completion of the second engine, said to be superior in power and beauty to the first; and also of the reception of some parcels of ore of extraordinary richness, raised from the mines restored to use by the operation of these machines. The Gazette also announces the arrival of the other engines; 'but that,' it continues, 'which is of still greater importance, is the arrival of Don Ricardo Trevithick, an eminent professor of mechanics, machinery, and mineralogy, inventor and constructor of the engines of the last patent, and who directed in England the execution of the machinery now at work in Pasco. This professor, with the assistance of workmen who accompany him, can construct as many engines as shall be wanted in Peru, without the necessity of sending to Europe for any part of these vast machines. The excellent character of Don Ricardo, and his ardent desires to promote the interests of Peru, recommend him to the highest degree of public estimation, and make us hope that his arrival in this kingdom will form the epoch of its prosperity through the enjoyment of its internal riches, which could not be realized without such assistance; or if the British government had not permitted the exportation from England: an object hitherto deemed unattainable by all who know how jealous that nation is of all her superior inventions in the arts or industry.'

"So much importance was attached to Don Ricardo Trevithick's personal superintendence, that the

* Mr. William Bull, of Chasewater, Cornwall, who was one of the three Cornishmen that accompanied M. Uvillé: Thomas Trevarthen, of Crowan, and Henry Vivian, of Camborne, were the other two.

viceroy ordered the lord warden of the mines to escort him with a guard of honour to the mining district, where the news of his arrival in Peru caused the greatest rejoicings; and many of the chief men came to Lima, a distance of many days' journey over the mountains, to welcome him. M. Uvillé had written to his associates, 'that heaven had sent him out for the prosperity of the mines, and that the lord warden had proposed to *erect his statue in massy silver.*'"

(*To be continued.*)

DICTIONARY OF CHEMISTRY.

Bournonite, *antimonial sulphuret of lead.*

Bovey Coal. A particular kind of coal, found in various parts of Europe; it consists principally of wood thoroughly penetrated with bitumen.

Boyle's fuming Liquor, *hydroguretted sulphuret of ammonia.* A substance first described by the great philosopher whose name it bears.

Brains have been analysed, and found to contain 80 water, 4.53 fatty matter, .07 reddish fatty matter, 7 albumen, 1.12 osmazome, 1.5 phosphorus, 5.5 acid, salts and sulphur.

Brandy. The spirit made by distilling wine. It is chiefly made in Languedoc in France. When re-distilled it is called *spirit of wine,* and *alcohol.*

Brass. An alloy of copper and zinc.

Brassica Rubra, *red cabbage.* Its leaves exposed to boiling water make an excellent test for acids and alkalies. The dried leaves answer the same purpose.

Brazil Wood. The wood of the *cæsalpina crista,* a tree which grows in the Brazils, and from which, by boiling, a fine red dye is extracted.

Brimstone, *sulphur.*

Brionia Alba. A root formerly much used in medicine, and now known to consist almost wholly of starch.

British Gum is made by exposing starch to a temperature between 600° and 700°.

Bronze. An alloy of copper, tin, and some other metals.

Brucia, *brucine.* A vegetable alkali, extracted from the bark of the false angustura.

Brunswick Green. A muriate of copper and ammonia, used for painting.

Butter. The oily part of milk.

Butter of Cocoa. An oily solid substance, firmer than suet, obtained from the cocoa nut, and used as an ingredient in pomatums.

Cabbage, *brassica rubra.* Red cabbage is used to form a test paper.

Cadmia. The name which the ancients gave to some ore which is supposed to have contained zinc.

Cadmium. An undecompounded metal, first discovered in 1817.

Caffein. A peculiar principle obtained from coffee. It is a very delicate test for iron.

Cajeput Oil is obtained from the leaves of a tree found at Amboyna and other Molucca islands.

QUERIES.

To the Editor of the Chemist.

Sir,—I have had the misfortune to change the blue colour of my trowsers green, by means of very strong nitric acid, and have tried caustic alkalies and a great many other substances, without producing the blue colour. If any of your Correspondents can inform me how to change the green blue, I shall feel great pleasure in trying the experiment. Perhaps I should remark, that it has been done about three weeks.

I remain, Sir,
Yours, &c.
T. P.

The best method of making a strong cement, in which rosin, and chalk, or plaster of Paris, are the chief ingredients? G.

Mr. Editor,—I should be glad if any of your intelligent corre-

spondents could inform me the easiest method of making oxalic acid, in crystals, in a small way, say about one ounce. I have attempted it, and cannot succeed, the residuum being flat, and similar to iodine crystals, but with all the taste of the oxalic acid.

I remain, Sir,
Your constant reader,
A Young Chemist.

I should be also glad to know the easiest method of making a similar quantity of Epsom salts, and what causes their crystals to be so small; and if by any process they could be made larger in either the acid or salt.

CHEMISTRY AS A SCIENCE.

Art. XXIII.

GENERAL CHARACTERISTICS OF THE METALS.

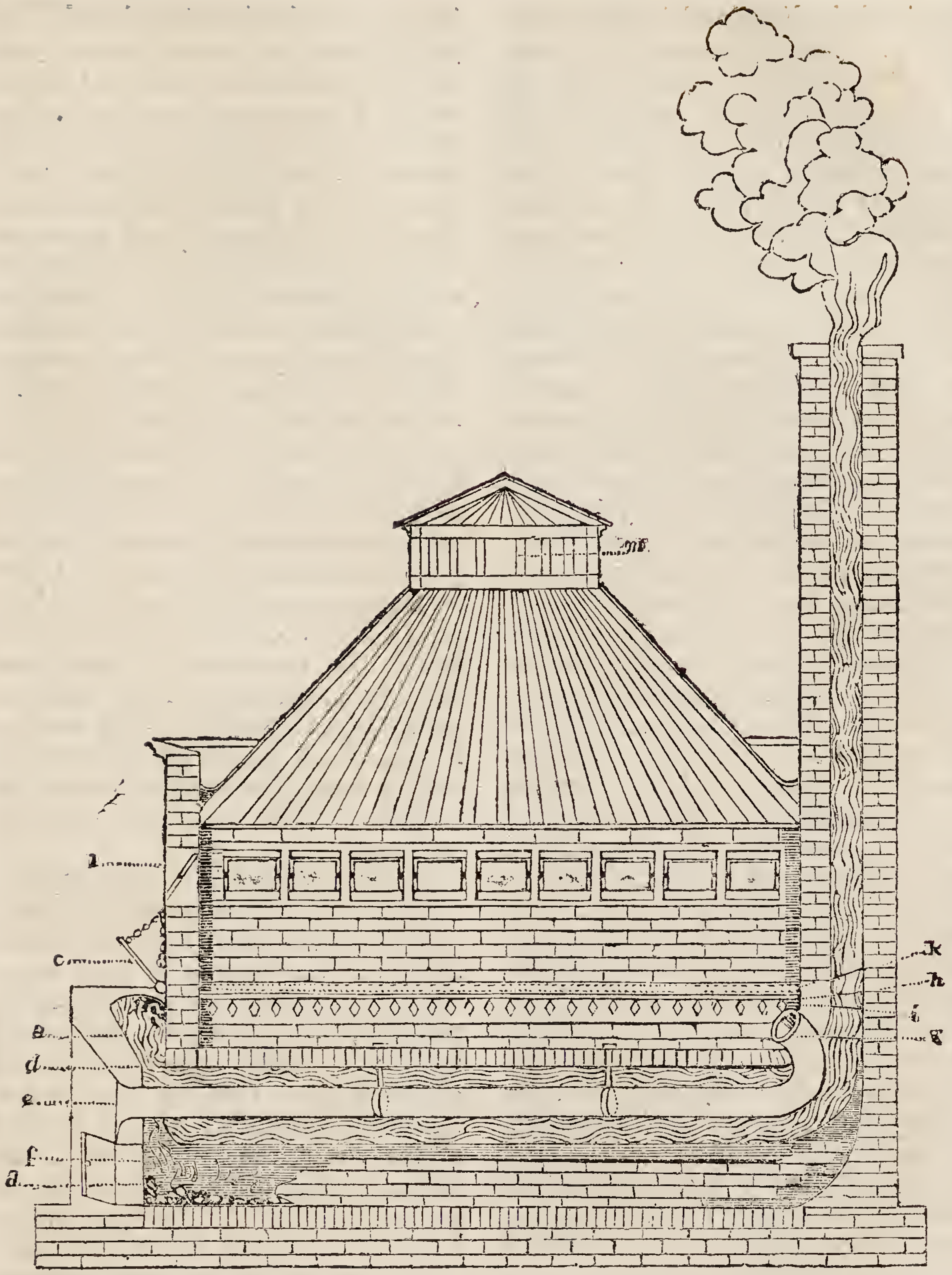
In our last Number we brought to a close the account which we intended to give of the simple undecompounded substances. But before we proceed to speak of light and heat, or what are usually called imponderable, and ought also to be called untangible, unseen *substances*, we shall present our readers with a tabular view of the characteristics of the metals. Not above seven metals were know to the ancients, but we have mentioned upwards of forty with which the moderns are acquainted. Some of them, indeed, have not been very accurately investigated, and it may hereafter perhaps turn out that they ought not to have a separate existence assigned them; but many have been thoroughly examined, and the existence of at least three times seven is established almost beyond the possibility of subsequent discoveries to annihilate it. It may possibly happen that a metallic principle or principles shall be discovered, such as the alchymists supposed might exist, and every individual metallic substance may be shown to be only some modification of it; but at present we have no right to assume the existence of any such principle, and thus the forty-two metals must be considered as elementary substances. For the increase of our knowledge on this point we are entirely indebted to scientific chemists, and many of the metals have been discovered by means of the galvanic battery, which, in the hands of Sir Humphrey Davy and other eminent chemists, has, in a manner, given an entire new aspect to the science. The full powers of the instrument, and the laws of galvanism being as yet but imperfectly known, considerable alterations in our views may yet be anticipated. To give the reader an idea of the change which has already taken place, we may observe, that only a few years ago the entire crust of the earth was supposed to consist of a distinct species of bodies, to which the term earths was appropriated. So marked was the scientific difference, that Mr. Parkes, in his Chemical Catechism, observes, "If *minerals* had been placed on the surface of the globe, they would have occupied the greatest part of the earth, and have prevented its cultivation." Whatever scientific view may be taken of the nature of the substances on the surface of the globe, their fitness for the purposes of vegetation, and supplying man and animals with food, will remain unaltered; but it is now proved beyond a doubt, that these substances are minerals, and of that species of mineral which in general is most hostile to cultivation, namely, *metals;* but metals with such an affinity for oxygen, that "Volta's magical pile," it has been observed, "directed by the genius of Davy, can only suspend for a moment the despotic sway of oxygen,—the emancipated metal soon relapses under its dominion." So that oxygen, which we have already had occasion to describe as playing such an important part in all the phenomena of animal and vegetable life, is also the *principle* which gives fertility to the soil, and endows the most barren and sterile substances with the quali-

ties proper to supply us with food. In this circumstance, when it is recollected that this vivifying principle abounds in the atmosphere, there is probably as much to admire as in that distribution which has placed, as is remarked by Mr. Parkes, the metals having a less affinity for oxygen below the surface, while those which have an intense affinity form the exterior coat of the globe. That any utility can be derived from these discoveries of modern chemists is not at first very obvious. Already, however, the power of galvanism over the metals has been put to several important uses; and it certainly cannot be predicated with any certainty that the discovery of the *metallic* bases of all soils, and that oxygen is their vivifying principle, will never lead to some great improvement in the art of cultivation. Agricultural chemistry is scarcely yet born; and so much has been effected by chemical discoveries in other branches of art, that there is reason to expect, whenever they are applied to agriculture, greater wonders of production will be realized than the world has yet seen.

We have to remark of the following table, that the statements are all taken from the works of Drs. Thompson and Ure. The tenacity of metals given, is from the former; and the figures signify the number of pounds weight required to break a metallic wire 0,078, of an inch in diameter. It may, too, be necessary also to explain to some of our youthful readers what is meant by SPECIFIC GRAVITY. They know that all bodies have a tendency to fall to the centre of the earth, which is called their weight. Different substances possess this tendency in different degrees; which seems, however, from some well known experiments with the air pump, to depend on the medium in which they are suspended, or through which they move. To ascertain the different weights of different substances, one medium must always be had recourse to; and as it is much easier to collect the quantity of water a substance displaces, than the quantity of air, and thus determine the space it occupies; and as we only say one body is heavier than another, because its tendency to sink, or its weight, equals that of another body which occupies a larger space, water is the medium used for determining the specific gravity of bodies by chemists. Specific gravity, therefore, signifies the relative weight of a certain quantity of any body to a precisely similar quantity of water. As water itself, however, has weight, it is called 1.000, and the figures signifying specific gravities actually stand for this relative weight; and in addition thereto, if the body be heavier, 1.000 for the weight of the water, and if lighter, they stand for a sum less than that weight. The mode in which the specific gravities of bodies are determined is, to weigh them first in air, and then in water. In the latter case they lose weight precisely equal to the weight of their own bulk of water; and hence, by comparing its weight with the weight in air, we find their specific gravity, or their relation to the same bulk of water. The rule is to divide the total weight by the loss of weight in water, the quotient is the specific gravity. If it be a liquid, or a gas, it is weighed in a vessel of known capacity, and dividing that weight by the weight of the same bulk of water, the quotient is the specific gravity. Water is always taken at the temperature of 60° of Fahrenheit. In point of fact, therefore, the specific gravity of bodies, means only their weight in water, an additional 1.000 being added for the water. We are enabled by this method to make more accurate comparisons between different substances than we could by weighing them in air, but employing it gives us no positive addition to our knowledge. Platinum and potassium will be relatively heavy, whether weighed in air or water; and hydrogen still remains the lightest substance we know, whether compared with one or the other.

CHARACTERISTICS OF THE METALS.

NAMES.	Specific Gravity.	COLOUR.	Malleable or Brittle.	Tenacity.	MELTING POINT. Fahr.	MELTING POINT. Wedgewood.	PRECIPITANTS.	COLOUR OF PRECIPITATES BY Ferroprussiate of Potash.	Infusion of Galls.	Hydro-sulphurets.	Sulphuretted Hydrogen.
Iron........	7. 7	Grey	M	549.25	..	158°	{ Succinate soda, with per oxide }	Blue, bluish-white	Peroxide, black	Black	Black
Nickel......	8. 4	White	M	..	..	160+	Sulphate of potash ?	White	Grey-white	Do.	Milkiness
Cobalt	8. 6	Grey	B	..	..	130	Alk. carbonates	Brown-yellow	Yellow-white	Do.	Milkiness
Manganese	8. 0	Grey	B	..	..	160	Tartrate of potash	White	White	White	Brown
Cerium	?	White ?	B	..	..	..	Oxal. of ammonia	Milk-white	Red-brown	White	
Uranium ..	9. 0	Grey	B	..	..	170+	Ferropr. of potash	Brown-red	Chocolate	Brown-yellow	Yellowish-white
Zinc	6. 9	White	M	109. 8	680°	..	Alk. carbonates	White	....	White	Ditto
Cadmium ..	8. 6	White	M	..	..	..	Zinc	White	....	White	Black
Lead	11. 35	Blue	M	27. 7	612°	..	Sulphate of soda	White	White	Black	} Brown
Tin	7. 29	White	M	34. 7	442	..	Cor. sublimate (Perchloride of mercury)	White	....	{ Protoxide, do Per yellow	
Copper	8. 9	Red	M	302.26	..	27	Iron	Red-brown	Brown	Black	Black
Bismuth	9. 88	Reddish-wh.	B	20. 1	476	..	Water	White	Yellow	Black-brown	Black-brown
Mercury....	13. 6	White	M	..	39	..	Common salt, Heat	Yellowish-white	Orange-yellow	Brownish-black	Black
Silver	10. 45	White	M	187.13	..	22	Common salt	White	Yellowish-brown	Black	Black
Gold	19. 30	Yellow	M	150. 7	..	32	{ Sulph. iron Nitrate mercury }	Yellowish-white	Green, metallic	Yellow	{ Black met. powder Yellow
Platinum ..	21. 47	White	M	274.31	..	170+	Muriate of amm.	....	....	....	Black met. powder
Palladium ..	11. 8	White	M	..	..	170+	Prussiate of mercury	Deep orange	....	Blackish-brown	Black-brown
Rhodium ..	10. 65	White	B	..	..	180+	Zinc ?	....	....	....	
Iridium	18. 68	White	M	..	..	180+	Do. ?	....	....	....	
Arsenic .. {	8. 35 5. 76	Bluish-wh.	B	..	..	..	Nitrate of lead	White	....	Yellow	Yellow
Antimony ..	6. 70	White	B	..	810	..	Water and zinc	White with dilute solutions	White	Orange	Orange
Chromium..	5. 90	White	B	..	..	170+	Nitrate of lead	Green	Brown	Green	
Molybdenum	8. 6	White	B	..	..	170+	Do	Brown	Deep brown	....	Brown
Tungsten ..	17. 4	White	B	..	..	170+	Muriate of lime ?	....	....	....	
Tellurium ..	6.115	White	B	..	..	..	Water and antimony	....	Yellow	Blackish	
Columbium	5. 6	Grey	B	..	..	170+	Zinc	Olive	Orange	Chocolate	
Titanium ..	?	Yellow	B	..	..	170	Inf. of galls	Grass-green	Red-brown	Grass-green	
Selenium ..	4. 3	Blue	B	..	220	..	{ Iron Sulphate of amm. }	....	....		
Osmium....	?	Dark grey	M	..	..	..	Mercury.	....	{ Purple, passing to dark blue		



DISTILLATION.

Art. II.

MALTING.

Malting consists in making grain germinate artificially to a certain extent, and then stopping the process. Every species of grain may be subjected to it, but some species answer the purposes of the distiller and brewer much better than others, and in this country in general only barley is malted. With some species of grain, such as Indian corn, the germination must be carried to a considerable extent, and it is actually buried under the earth, or sown for a short time, and when it has sprung up, it is removed and washed, or otherwise cleaned, and then dried in the kiln like other malt. In this country the process, as described by an accurate chemist, is as follows:—

The barley is steeped in cold water for a period which (as regulated by law) must not be less than forty hours; but beyond that period the steeping may be continued as long as is thought proper. Here it imbibes moisture, and increases in bulk; while at the same time a quantity of carbonic acid is emitted, and a part of the substance of

the husk is dissolved by the steep-water. The proportion of water imbibed depends partly on the barley, and partly on the length of time that it is steeped. From the average of a good many trials, it appears that the medium increase of weight from steeping may be reckoned 0.47; that is to say, every 100 pounds of barley when taken out of the steep weighs 147 pounds. The average increase of bulk is about a fifth; that is to say, that 100 bushels of grain, after being steeped, swell to the bulk of 120 bushels. The carbonic acid emitted while the barley is in the steep is inconsiderable; and it is probable, from the experiments of Saussure, that it owes its formation, at least in part, to the oxygen held in solution by the steep-water.

The steep-water gradually acquires a yellow colour, and the peculiar smell and taste of water in which straw has been steeped. The quantity of matter which it holds in solution varies from 1-50th to 1-100th of the weight of barley. It consists chiefly of an extractive matter, of a yellow colour and disagreeable bitter taste, which deliquesces in a moist atmosphere, and contains always a portion of nitrate of soda. It holds in solution most of the carbonic acid disengaged. This extractive matter is obviously derived from the husk of the barley, and is that substance to which the husk owes its colour. Accordingly, grain becomes much paler by steeping.

After the grain has remained a sufficient time in the steep, the water is drained off, and the barley thrown out of the cistern upon the malt-floor, where it is formed into a rectangular heap, called the *couch*, about 16 inches deep. In this situation it is allowed to remain about 26 hours. It is then turned, by means of wooden shovels, and diminished a little in depth. This turning is repeated twice a day or oftener, and the grain is spread thinner and thinner, till at last its depth does not exceed a few inches.

When placed on the couch, it begins gradually to absorb oxygen from the atmosphere, and to convert it into carbonic acid; at first very slowly, but afterwards more rapidly. The temperature, at first the same with that of the external air, begins slowly to increase; and in about ninety-six hours the grain is, at an average, about 10° hotter than the surrounding atmosphere. At this time the grain, which had become dry on the surface, becomes again so moist that it will wet the hand, and exhales at the same time an agreeable odour, not unlike that of apples. The appearance of this moisture is called *sweating*. A small portion of alcohol appears to be volatilized at this period. The great object of the maltmen is to keep the temperature from becoming excessive. This they do by frequent turning. The temperature which they wish to preserve varies from 55° to 62°, according to the different modes of malting pursued.

At the period of the sweating the roots of the grains begin to appear, at first like a small white prominence, at the bottom of each seed, which soon divides itself into three rootlets, and increases in length with very great rapidity, unless checked by turning the malt. About a day after the sprouting of the roots, the rudiments of the future stem, called *acrospire* by the maltsters, may be seen to lengthen. It rises from the same extremity of the seed with the root, and advancing within the husk, at last issues from the opposite end: but the process of malting is stopped before it has made such progress.

As the acrospire shoots along the grain, the appearance of the kernel, or mealy part of the corn, undergoes a considerable change. The glutinous and mucilaginous matter is taken up and removed, the colour becomes white, and the texture so loose that it crumbles to powder between the fingers. The object of malting is to produce this change: when it is accomplished, which takes place when the acrospire has come nearly

to the end of the seed, the process is stopped by drying the malt upon the kiln. The temperature at first does not exceed 90°; but it is raised very slowly up to 140°, or higher, according to circumstances. The malt is then cleaned, to separate the rootlets, which are considered as injurious.

Such is a short sketch of the process of malting. Barley, by being converted into malt, generally increases two or three per cent. in bulk; and loses at an average about a fifth of its weight, or 20 per cent. But of these 20 parts 12 are to be ascribed to kiln-drying, and consist of water, which the barley would have lost had it been exposed to the same temperature: so that the real loss does not exceed eight per cent. From a good many trials, made with as much attention to all the circumstances as possible, the following seems to be the way of accounting for this loss:—

Carried off by the steep-water	1.5
Dissipated in the floor	3.0
Roots, separated by cleaning	3.0
Waste	0.5
	8.0

The loss on the floor ought to be entirely owing to the separation of carbon by the oxygen of the atmosphere; but were this the only cause, it would be much smaller than three per cent. Two other causes concur to produce this loss:—1. Many of the roots are broken off during the turning of the malt; these wither and are lost, while others grow in their place. 2. A certain portion of the seeds lose the power of germinating, by bruises or other accidents, and these lose a much greater portion than three per cent. of their real weight. From a good many trials, made with as much care as possible, I am disposed to conclude that the quantity of carbon separated during the whole process of malting, by the formation of carbonic acid gas, does not exceed two per cent., and that the weight of the roots formed amounts often to four per cent. These two, in reality, include the whole real loss of weight which barley sustains when malted.—What is lost in the steep, being husk, need scarcely be reckoned.

The roots appear, from the process, to be formed chiefly from the mucilaginous and glutinous parts of the kernel. The starch is not employed in their formation; but undergoes a change, intended no doubt to fit it for the future nourishment of the plumula. It acquires a sweetish taste, and the property of forming a transparent solution with hot water. In short, it approaches somewhat to the nature of sugar; but is much more soluble, and much more easily decomposed, than that principle. From the experiments of Saussure on the conversion of starch into sugar, there is reason to conclude that this change is brought about by the combination of the starch with water. The action of hot water on barley-meal seems gradually to induce a similar one.

Our plate represents a side view of a malt-kiln, in which the malt is dried by heated air, but in which the air necessary for the combustion of the fuel descends through the grate. *a*, the fire. *b*, the grate. *c*, the door of the furnace. *d*, the door of the ash-pit. *e*, the air cylinder. *f*, the ash-pit. *g*, the end of the air cylinder entering the space below. *h*, the kiln head, which is composed of tiles perforated with small holes lying on the joists *i*, and supporting the malt *k*. *l*, *l*, the windows, through which a current of air may freely enter or escape. *m*, the air outlets above. If a distiller finds his works so relatively situated that he can lead the air cylinder of his malt-kiln through the flue of his still or mash boiler furnace, the expense of fuel for drying malt will be saved.

ON THE CUTTING OF STEEL BY SOFT IRON.

The fact that soft iron made to revolve very rapidly will cut steel, has long been known. The follow-

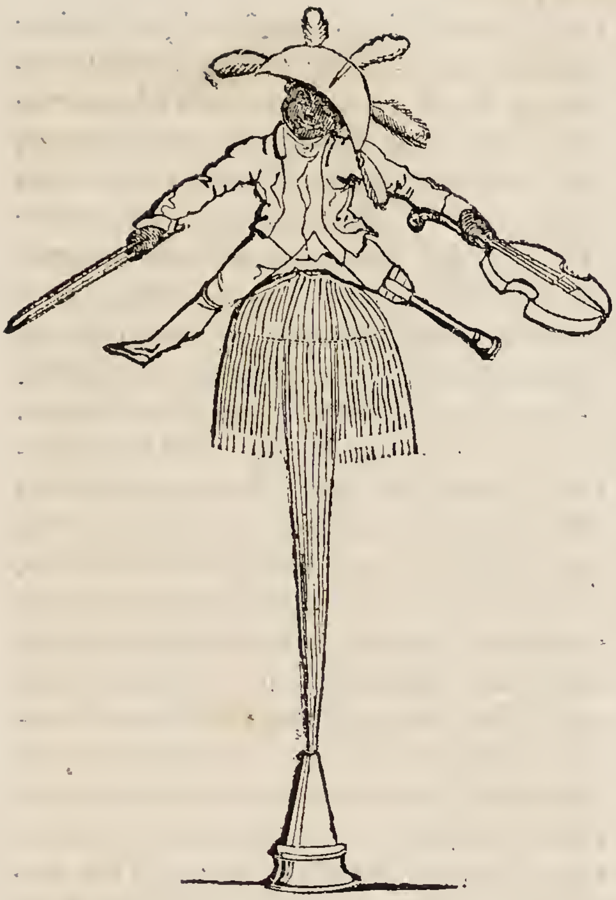
ing is an interesting account of the mode by which it is effected, as well as a good explanation of the principles of the operation :—

It seems to have been discovered by the Shakers, who are remarkable for the neatness and expertness of their mechanical operations. As it is desirable that the experience of others on this subject should be made known, I will now add, that in June last I saw Professor Robert Hare, at Philadelphia, execute, with a common foot-lathe, operations similar to those described by Mr. Daggett: they were, however, less energetic and decisive, as the machine did not produce so rapid a motion as that of Mr. Barnes.

I have, however, since repeatedly seen the experiment succeed, in the most perfect manner, at the manufactory of arms belonging to Eli Whitney, Esq., near this town (New Haven, Connecticut). As water power is here applied with great facility and energy, a wheel of soft and very thin plate iron, six inches in diameter, and furnished with an axis, was made to revolve with such rapidity that the motion became entirely imperceptible, and the wheel appeared as if at rest. When pieces of the best and hardest steel, such as files, and the steel of which the parts of gunlocks are made, were held against the edge of the revolving soft iron plate, they were immediately cut by it, with a degree of rapidity which was always considerable, but which was greater as the pieces of steel were thinner; pieces as thick as the plate of a common joiner's saw, were cut almost as rapidly as wood is cut by the saw itself. Considered as an experiment merely, it is a very beautiful one, and in no degree exaggerated in Mr. Daggett's account: there is a very vivid coruscation of sparks, flying off in the direction of tangents to the periphery of the cutting-wheel; and an intense ignition of the steel, extending for a considerable distance ahead of the section, and on its sides, attends the operation. The impulse against the steel is so strong, that in several instances it was thrown against the opposite side of the room with a velocity that might not have been without danger to a person standing in the way. It may be said, I believe, with safety, that none of the ordinary mechanical operations commenced upon cold and hard steel, will divide it with so much rapidity as this mode of applying soft iron. After all, it is evident that it is only a peculiar method of cutting red hot, or possibly white hot steel; for the mechanical force produces these degrees of heat, and it is one of the best methods of evolving heat by mechanical impulse. The steel of course loses its temper at the place of section, and there only; for the softening extends but a little way, and is limited to a narrow portion, mark- by the iris colours known to be produced by heat upon steel.

The iron plate, as Mr. Daggett states, becomes only warm, and wears away, only very slowly; yet it does wear, for the edges are left rough, and the channel of section in the steel exhibits, with a magnifier, minute striæ or grooves, running in the direction of the wheel's revolution. I know not that there is any reason to suppose any peculiar electrical phenomenon, except that electricity always accompanies heat. It is plain from the important use made of this mode of cutting steel by the Shakers and by Mr. Barnes, that it may be of considerable practical importance.

As a philosophical experiment it is highly interesting: and it remains yet to be shown, why the heat evolved by the impulse should nearly all be concentrated in the steel, and be scarcely perceptible in the iron: neither is it perfectly clear that even ignited steel should be so easily cut by the impinging of soft iron. No smith probably ever thought of attempting to divide steel by applying an iron tool. — *Silliman's Journal*, vol. vii. p. 342.



THE DANCING FOUNTAIN.

To the Editor of the Chemist.

SIR,—I believe you English are so satisfied with yourselves, that you never inquire into the knowledge of others, and are consequently more ignorant of the discoveries and amusements of other people than any other nation on the face of the earth. I see by an early Number of The Chemist that one of your great philosophers amused his pupils in Edinburgh, by exhibiting to them a hollow brass sphere balanced on a jet of water, " and made to play up and down in a very striking manner,"* as a novel and curious experiment. Sir, this has been practised time out of mind in my country, which is Germany, and in Holland, and in a much more amusing manner than that described by the Professor. You know, Sir, that fountains, or what you call *jets d'eau*, are very common on the Continent, and there it is the practice to have them in our gardens, and within little temples, and when one is found in such a convenient situation, our boys and girls know how to amuse themselves in the manner your Professor taught his pupils. They take pieces of cork, which they cut into various shapes, like the figure I send you, which is the representation of one that I made when I was myself a boy, and they either paint them or clothe them lightly. Within what you call the seat of honour a hollow sphere or ball, made of very thin copper or brass, is fixed, and these little figures are then placed over a perpendicular jet d'eau, and there do they dance and turn round like what you call " *merry go rnads.*" Your Professor who taught this to his scholars, as a novel experiment, is known to have been a great traveller, and I have no doubt that he has seen, a hundred times, little figures dancing on the top of a stream of water, both in Germany and Switzerland. I hope, Sir, that you will give insertion to this letter, that the boys of my country may have the honour which is due to them for having forestalled the English philosophers.

I am, Sir,
Your very obedient humble servant,
EIN DEUTSCHER.

P.S. If you insert this communication I shall perhaps send you an account of some other of our boys' tricks.

* See No. XI. of Chemist.

The Editor will be happy to receive the communications of his German correspondent; but he must observe, that he is not aware that Professor Leslie exhibited this experiment as a novelty, but only as an illustration.

ANALYSIS OF SCIENTIFIC JOURNALS.

(*Continued from* p. 343.)

THE TECHNICAL REPOSITORY FOR AUGUST.

WE should not have taken any notice of the Technical but for one paragraph. Mr. Gill states, that " Government has given orders for the construction of no less than *twenty-four steam engines, each of the power of forty horses.*" " We are truly glad to hear," he adds, " of this public spirited conduct on the part of Government, and trust that it may lead to a still further encou-

ragement on its part of our other important national inventions, such as the Hydraulic Press, &c. &c., and thereby obviate the *necessity* of seeking a market for them in foreign parts." Our readers will probably require to be informed that Mr. Gill is an opponent of the wish entertained by our machinists and iron manufacturers, to get the best and most extended market possible for the produce of their labour; and he penned the above paragraph, with a view of weakening, by holding up the encouragement they receive from Government, their claims to have those laws repealed which now impede the free exercise of their industry. In point of fact, however, the Government has ordered these engines from no public spirited motive. It has, at length, found, that the service of the post office, in keeping up a regular communication with different parts of our own and foreign countries, can be best performed by steam vessels. A certain number has, therefore, been ordered, and they are now building in his majesty's dock yards. The steam engines are for these vessels, and the Government displays no more public spirit in ordering them, that has been evinced by the Edinburgh and Margate steam packet Companies, in ordering almost an equal number. Having thus shown the nonsense of Mr. Gill's unnecessary praise, we shall now say a word or two on the further nonsense of wishing *the Government to encourage our national inventions, and thereby obviate the necessity of seeking a market for them in foreign parts.*

If the Government needs such machines for any useful purpose, it can get them nowhere but from our own manufacturers; and so far we hope that it will not be so egregiously silly as not to order them. But every one of these engines, and every other of its expenses, is paid for by taxes on the people, and we ask Mr. Gill if he would have the people taxed for the benefit of Messrs. Boulton and Watt, who are already very rich, or for the benefit of any other maker of engines? To order engines from them, unless they are wanted, like these for the steam post-office packets, for a profitable purpose, is only employing the money and industry of the people in putting up machines, that will cost a still further sum to keep them in repair, or will go to decay. A market for our goods in foreign countries is precisely what numerous treaties have been made to obtain, and the necessity for which no *rational* man seeks to obviate. Nature has bestowed on different countries different climates and different productive powers, and on their inhabitants different capacities. She has scattered her benefits profusely in all parts, but not bestowed on any two parts an exactly similar blessing. The necessity, therefore, which Mr. Gill wishes to obviate, of one country finding a market for its produce in other countries, arises from the nature of things, and if obviated, would leave no two countries of the world any means of assisting each other, or cultivating mutual friendship. Man would then be every where a savage.

> "A bounteous plenty is the robe,
> And trade the golden girdle of the globe."

When we find a market for our commodities in foreign parts, we receive in exchange from their inhabitants some of the products of their industry, which are to us of more value than those things we gave for them. This is what Mr. Gill would do away. He wishes that one part of the people should be taxed, to the great increase of custom and excise officers, impeding locomotion and industry, begetting numbers of crimes, such as false oaths and smuggling, with all its horrors of resistance and murder, for the benefit of some machinists, rather than that they should be allowed to exchange the produce of their labour with some men living across the English Channel, for something they regard as more valuable. And this is the learning and wisdom which Thomas

Gill, Chairman of the Committee of Mechanics, &c. &c. labours to impart to the public. We hope the youthful readers of the Chemist will never adopt such absurd prejudices, and will never swell with their voices that anti-human cry, which a few interested and unthinking men raise to check, though by inflicting privations and misery on ourselves, the prosperity of others.

DISCOVERY OF A MINE OF QUICKSILVER AT IDRIA, IN CARNIOLA.

A Carniolean peasant, who drove a small trade in wooden vessels, was in the habit of groping his way into a recess of the mountains, at that time entirely covered with wood, to procure materials for his tubs and pails, which he sometimes finished on the spot. He had placed some pails over night in a small pool in a rivulet which flowed from the mountain, for the purpose of seasoning them. To keep them under water, he put into them a quantity of sand, taken from the bed of the stream. In the morning he was scarcely able to lift one of his pails out of the water. He could ascribe this only to the weight of the sand, and sand so heavy was to him a phenomenon, and he carried some of it to the pastor of his village. The latter, suspecting what might be the reason, sent some of it to the Imperial director of the mines, and on examination, it was found to contain half its weight of quicksilver. The whole of the department of Idria was immediately declared a domain of the crown, but the mines were first worked by private adventurers, on leases; and the miners still preserve various traditions of the difficulties these speculators had to encounter. Shafts were driven deep into the solid rock, but no quicksilver was found; patience and money were wearing out, and the speculators gradually drew back, leaving it all at last in the hands of one more sanguine and persevering than the rest. He too hoped and laboured in vain; ruin came, not quicksilver, and the destitution into which he had plunged his family by his unsuccessful adventure, brought him to the grave. His widow was compelled to give up the operation, but the workmen declared they would still make an attempt for the family of him who had so long given them bread, and continued their search fourteen days longer without wages. The fourteenth day arrived, but no quicksilver was found. Towards the afternoon, as the workmen, who had been annoyed all day long by sulphurous vapours, and a more uncomfortable atmosphere than usual, were about to give up their task for ever in despondency, and prepare to celebrate above ground the festival of their patron saint, of which this happened to be the eve, a shout from the lowest part of the shaft announced that the deeply concealed vein had at length been dragged from its lurking place. The saint was neglected, and the mercury pursued. It was soon ascertained that the labour and expense of years were sure to be amply repaid. The revived widow prudently sold her right to the government, and since that period, now 400 years ago, Idria has not ceased to pour its thousands into the Imperial treasury.

REPLY TO CASTIGATOR.

August 14*th.*

Had I known, Mr. Editor, when I offered for insertion my two Queries on Onion Juice and Tallow, that I had so critical a palate to please as that of "Castigator," I might certainly, instead of presenting them together, have served them up in two courses; but as I did not wish to give you unnecessary trouble, I thought it best to act as I did. In what manner they have been so "*strangely united*," as Castigator says they are, I cannot conceive; since, when I last saw them in your pages, they were *perfectly distinct and separate*, although not half a mile apart. It appears to me very singular that this gentleman should *not* be able to foresee

every future "application of fat and onions," considering the great abilities which he must necessarily possess, to qualify him for the office of castigator and corrector of opinions.

My intelligent respondent asserts, that onions may be kept from harvest to harvest; he might have added,—so may potatoes; but can he say that they will retain all their original strength and good qualities? He also kindly informs me, that fat is a general name for several kinds of animal oil, while tallow is a particular species of fat; but unfortunately he has forgotten to describe the "particular species," which, together with the method of separating its acid and membranous parts, is all the information I require, since I cannot procure it at the tallow-chandler's sufficiently pure my purpose. As I am accused of want of precision in my mode of stating these two queries, I should feel obliged if Castigator will put them into the *precise form and attitude* necessary to elicit the information required; and I repeat, that the information I want, is—

1st. Whether there *is* any mode of extracting and preserving the juice of onions, and in what it consists.

2d. From what "particular species of fat" tallow is prepared, and the mode of preparation and purification.

With many thanks to you, Sir, for your kind and early insertion of my queries, and to Castigator for his *kind and early attention* to them, I remain,

Your obliged and obedient servant,

A Constant Reader.

The Editor thinks he will do right to put a stop to this controversy by answering the queries himself. He has never heard of any extract being made from onions for preservation. Squills, sea onions, and all such things, which are preserved many years, are dried, and are infused when wanted. Flower roots, analogous in their nature to onions, are preserved many years. As common onion is of the same genus, he supposes this method would also answer with them. He knows that if care is taken of them and they are dried, they are as good at the next harvest as when taken out of the ground. They are preserved by being slightly kiln-dried, or by having the root and top seared with a hot iron. At the same time, he will readily insert any more satisfactory answer to his Correspondent's query. Tallow or fat may be obtained pure by cutting suet or hogs'-lard in small pieces, washing it well in water, and mechanically separating the membranous parts. It is then to be melted in a shallow vessel with a small quantity of water, and kept melted till the water is completely evaporated. It is white, tasteless, and nearly insipid. Mr. Chevreuil has proved that this fat may be again separated into distinct substances, one of which is fluid and the other solid, at the temperature of the atmosphere. In The Chemist, No. IV. the mode of separating the two has been described; the solid part, which is called stearine, may also be thus procured:—Hogs'-lard, purified as completely as possible from foreign matter, is to be dissolved in boiling alcohol; when this cools it deposits white crystalline needles, which are stearine. Repeating the process, the whole of the lard may be dissolved, and the crystallized stearine is afterwards again dissolved in alcohol, and once more allowed to crystallize, by which it is obtained nearly pure. The method described in our No. IV. will also give the stearine pure. This will probably suit our Correspondent's wishes.—Ed.

TO CORRESPONDENTS.

A. Z., A Stone, *and* Philo-Chemicus, *all came too late for the present Number.*

Observator *is intended for publication.*

*** *Communications (post paid) to be addressed to the Editor, at the Publishers'.*

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The Chemist.

"—— Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if nought in these external scenes
Can move thy wonder?——"

No. XXV.] SATURDAY, AUGUST 28, 1824. [Price 3*d.*

Fig. 1.

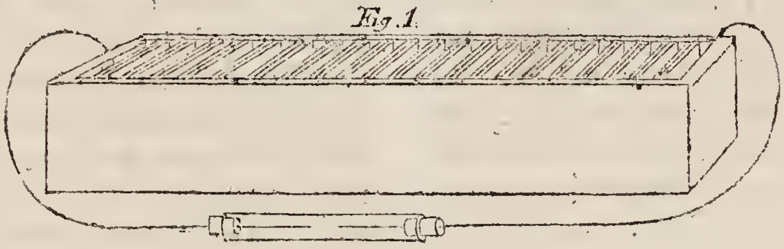
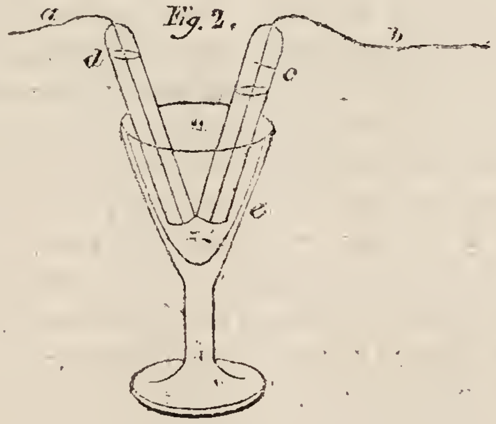


Fig. 2.



CONTENTS.

TO DECOMPOSE WATER BY GALVANIC ELECTRICITY.

(*From a Correspondent.*)

To effect this it is quite necessary that your correspondent should provide himself with a galvanic battery, or he may make a voltaic pile, one of which I see has been already described in The Chemist, at page 172, No. XI. The wires should be of platina, as with other metals all the oxygen of the water will combine with the wire, and the hydrogen gas alone be disengaged. To merely effect the decomposition without procuring the products separately, a glass tube must be procured, and after being nearly filled with water, must be corked up at both ends. The two

wires from the opposite ends of the battery must then be thrust through the corks, as seen in the plate, and brought pretty nearly into contact. Immediately they come into this position, bubbles of air will be emitted from each wire. By the decomposition of the water, the oxygen gas is evolved at the positive, and hydrogen at the negative pole of the battery. It is not likely, however, that your correspondent will be satisfied, Mr. Editor, unless he collects the two gases in separate vessels. For this purpose he must provide himself with the two glass tubes, *d* and *c*, Fig. 2, open at one end and corked up at the other. He must fill them with water, and place them inverted in the glass, *e*, or some similar vessel, and must then pass the wires, *a b*, from the battery through the upper ends of each tube, and bring them nearly into contact at the bottom of the glass. The instant this is done, oxygen is disengaged at the end of one wire, and hydrogen at the other, and each rises in its own separate tube; and they are always found to be in proportion of two measures of hydrogen to one of oxygen. Before your correspondent makes this experiment, he should distil the water, to have it pure, or at least boil it, to separate the air and carbonic acid gas. I am, Sir,

Your obedient servant,

Milk-street, Cheapside, T. Z.
Aug. 2.

POISONING. IMPORTANCE OF CHEMICAL KNOWLEDGE.

Our readers will, most probably, have noticed the account of the trial of Wm. Jos. Hodgson, for administering poison to his wife, which took place on Wednesday, August 18th, at Durham. It has appeared in all the papers, and cannot have been read without having excited a painful interest. He is a medical man; his wife was unwell, and the medicines which the physician ordered were prepared for her under his direction. The parties were only married in January 1823, and the marriage, at least on the lady's side, was one of affection. No motive appeared for the deed, as her whole fortune had previously been in his power; and he had settled 1200l. on her for life, which was to revert to him at her death, in case she had a child. She had a child last Christmas, of whom the father was stated to be very fond; and his wife also described him as a kind husband. She was an unwilling witness, the prosecution, apparently, having been undertaken by her friends, who seem always to have been averse to the match; and she endeavoured to find an excuse for him, by stating him to be deranged. A physician had prescribed calomel and opium, on account of a rheumatic fever, and her husband administered the medicine. On Sunday evening, June 6th, his apprentice made up the medicine into a bolus, according to his directions, and carried it into the lady's room. From the testimony of her mother-in-law, it appears, that he afterwards took the bolus down stairs, and returned with it. By his wife's desire, also, he divided the bolus into pills, and gave them to her. She immediately felt a heat in her stomach and throat, such as she had not before felt at taking similar pills, and complained of it. There was nobody present with her but her husband and a servant, and on her complaining he gave her a draught, after which she felt sick. Her mother, a Dr. Brown, a physician residing at Bishop Wearmouth, and Messrs. Gregory and Gregson, two surgeons, were then all sent for. The following is Dr. Brown's description of the state of Mrs. Hodgson when he arrived, and of the steps taken subsequently to examine the contents of a phial chemically:—

"I found Mrs. Hodgson very ill indeed; her pulse very quick and small; her skin was covered with a cold clammy sweat; there was a sense of burning in the throat that she complained of, extending along the gullet to the pit of the stomach.

There was vomiting at very short intervals; large quantities of *mucus* thrown up, and liquids that had apparently been given her. If a person had taken *corrosive sublimate of mercury*, I should conceive such symptoms would have been amongst the first that appeared. Having understood that the draught was given, I inquired after the composition of that draught. I think the patient herself told me the draught had been given. She said she began to vomit immediately after she took that draught. I observed to the prisoner, that I thought the symptoms were such as an over dose of tartar emetic would produce. Tartar emetic is in appearance like calomel; there is a difference between them, and a person of skill would easily discern it. I went down into the shop to see whether any mistake had occurred, but I found the tartar emetic and the calomel so situated, that I thought no mistake could have occurred. I think it is quite impossible corrosive sublimate could be mistaken for calomel; it is in crystals. A person could not use it in a bolus without first reducing it into powder. Corrosive sublimate of mercury could not be mistaken for powdered opium. They are so dissimilar in appearance, that I think it is impossible a person with a candle could mistake one for the other. In the dark, if a person pours it into a glass, as it is in crystals, they must be conscious of its not being powdered opium. To make a bolus it is necessary to mix the powder with a knife on the slab. Corrosive sublimate would grate or jar so much under a knife, as to render a person mixing it conscious of it. When I found that I could not clear up the mystery that seemed to exist, I ordered a draught to be prepared, of magnesia, 30 drops of tincture of opium, and some water. That was prepared in my presence by the prisoner. It was carried up stairs, and taken by Mrs. Hodgson, but it was immediately thrown up again. I then prescribed another draught for her, consisting of the same quantity of tincture of opium, and two drachms of water. I was then in the bed-room. The prisoner went down to prepare it, and was absent for two or three minutes. On his return he had the apothecary's measure-glass in his hand, with the draught in it. The appearace of it was different from what I should have expected from my prescription. In the first place, it was more bulky. In consequence of that circumstance, I took the glass into my hand; it was also more turbid in appearance than it ought to have been; I tasted it.

"Mr. *Pollock*—It never was administered to the prisoner's wife. Could, then, this evidence be received?

"Mr. Justice *Bayley* was of opinion that it could.

"The witness then proceeded. The liquid had a caustic metallic taste, and had such a taste as a draught containing corrosive sublimate of mercury would have. It had not the appearance which the crystals of corrosive sublimate of mercury dissolved in water would have. I was convinced that there was laudanum in it. Corrosive sublimate of mercury has no smell when dissolved in water; laudanum has. I think the smell of this draught was the same as it would have been if pure. On tasting the draught, I called for water to rinse my mouth, and ordered Mr. Gregory to be sent for. The phial was then given to Mr. Gregory, and was afterwards analyzed in my presence. Corrosive sublimate was found to be contained in it. The quantity, upon a fair calculation, was 13 11-14ths grains. That quantity, if not rejected by the stomach and met by antidotes, would be quite sufficient to destroy life. I should rather question whether three grains of it would destroy life. Upon discovering this draught, I required the white of eggs in water to be given; that is the antidote generally recommended by the highest authority. There is a little discrepancy on the question; but it is supposed that the white of eggs changes the corro-

sive sublimate into calomel, and so makes it comparatively harmless. Previous to the giving of the white of eggs, none of the vomiting was saved; afterwards some of it was saved. After the white of eggs was given, it would be difficult to decide whether corrosive sublimate had been given, as it would be changed to calomel, and calomel had been given previously to Mrs. Hodgson. Some time after this draught had been given, Mr. Gregory, Mr. Gregson, the prisoner's father, the prisoner, and myself, went into the surgery. We examined the marble slab. We perceived the remains of a bolus, which we tasted. The taste was similar to that of the draught; it was that of corrosive sublimate. All the individuals present tasted it, the prisoner among the rest. They all said that it tasted of corrosive sublimate; the prisoner agreed with us as to the taste. I asked the prisoner to taste the draught, and also to taste the residuum on the slab. He did so; he agreed with me as to the taste of both. I was in his house from eleven o'clock at night till four the next morning. Something was said, that in case of Mrs. Hodgson's recovery, nothing was to be said about the transaction. I analyzed what came from Mrs. Hodgson's stomach; it amounted to nearly three pints. There was no precipitate of mercury in it. After the liquids she had taken, I did not expect to find any.

"Re-examined.—One reason which I had for not expecting to find precipitate of mercury was, that so much had been thrown away before I thought of preserving the contents of the stomach; and the second reason was, the decomposition which corrosive sublimate suffers from the white of eggs would make any result obscure. Before I administered the white of eggs, I had not thought of preserving the vomitings. If the translation of gout or rheumatism had caused the symptoms which I observed in Mrs. Hodgson's stomach, I think that they would not have been relieved by the application of the white of eggs. The white of eggs did relieve the symptoms in this case. I did not perform the analysis myself; I was present at it. The tests we applied to the liquid solution were carbonate of potash, lime-water, and ammonia. We made an amalgam; we reduced it back into such a substance as to be able to whiten gold with it.

"M. R. Gregory, a surgeon.—I saw a graduated measure-glass; I tasted it twice, and I said that I considered it to contain corrosive sublimate. Dr. Brown and Mr. Gregson, and the prisoner's father, went with me into the shop. We went to the slab, looked at it, and saw a place on which a bolus had been made. A very small quantity of matter still adhered to the slab. We scraped off a very small quantity. This was two hours after I had tasted the draught up stairs. I tasted it. The taste conveyed an impression to my mind that it was corrosive sublimate. It was the same with that of the draught. Mr. Ogden analyzed it. I saw it analyzed and submitted to the usual tests. [A paper produced.] That is my hand-writing. These are the notes of the analysis. The result of the experiment was, that the parties there were satisfied that the draught contained nearly 14 grains of corrosive sublimate. Mr. Barnard Ogden is in court.—He was not examined, as he stated himself to be a Quaker, and had a scruple against taking an oath.

"Mr. Gregson, another surgeon, was called. He corroborated, in the leading points, the testimony of the two former medical witnesses, and added, that the prisoner pointed out where the bolus was made. The tests applied to the phial were, first, carbonate of potash, that produced a pale brick-coloured sediment; the second test was ammonia; the third, lime-water. The sediment produced by the ammonia was a brownish white; and that produced by the lime-water, a yellowish brown. The fourth test was a galvanic test, be-

tween gold and zinc: the result was, gold whitened. The fifth test was by the tongue: result, styptic and metallic. There was on the slab sufficient of the composition left to be subjected to the galvanic test. I am not enough of a chemist to say whether, after we had all tasted it, there was enough to apply the tests of ammonia and lime-water. I consider the galvanic test infallible; in the test by the tongue one might possiby be mistaken. I have never made experiments myself, to know what the results of the experiments we made ought to be. I only know the results from my reading in chemistry.

"Dr. Brown examined by Mr. *Brougham.*—I was present at the application of these tests. I have experimented upon corrosive sublimate. Having done so, and knowing the tests which were applied to the liquid then produced, I should say that it was quite decisive as to the existence of corrosive sublimate. The effect of carbonate of potash would be to produce a precipitate of a brick-red. In this case the colour was a little affected by the laudanum with which it was mixed. If ammonia were applied as a test, the precipitate would be of a white colour; and if lime-water, of a yellow colour. If the galvanic test were applied, gold would be whitened. I take that to be the surest test of all.

"Cross-examined. — That test would produce the same effect if it were applied to the submuriate of potash, the oxymuriate of potash, the red precipitate, or any other preparation of mercury: it would decompose the mixture, and whiten gold. It would give no criterion except that mercury was there, but not any criterion whether it was there as an active poison or a harmless ingredient. Corrosive sublimate is not the only preparation of mercury soluble in water: liquid nitrate is also soluble. The result of the experiments we made was altered by the presence of the laudanum. In a solution of corrosive sublimate, I certainly think that galvanism is the best test that can be applied, as it shows the presence of a mercurial salt. Calomel is not in a state of chemical solution, and therefore cannot be suspended. If galvanism were applied as a test to a solution of corrosive sublimate, it would afford no certain test as to whether the liquid contained corrosive sublimate or liquid nitrate; but then it could be determined by either of the other three tests. I have mentioned lime-water, ammonia, and carbonate of potash. The taste of corrosive sublimate is very particular, and is quite distinct from that of all other mercurial salts with which I am acquainted. My mouth was so spoiled by tasting the corrosive sublimate that was in the phial, that I must speak with less confidence as to its existence in the residuum that was left upon the slab.

The prisoner was acquitted.—There was only a presumption, arising from the symptoms, that the lady had taken corrosive sublimate; and this presumption was strengthened by the circumstance of the presented draught containing corrosive sublimate; but from the contents of the stomach having been thrown away, no *proof* could be come at that the woman had taken poison, and, consequently, none that poison had been administered. What struck us as remarkable in this case was, the ignorance of medical men: two of them knew nothing whatever of chemistry; a person performed the analysis under the direction of another, and neither of these was the medical man who had witnessed the transaction, nor was either of them examined. Of Dr. Brown's evidence, which to us appears deficient and incomplete,—of the analysis, which appears to have been unskilfully performed,—we shall hereafter have something to say. We have at present merely brought the case under the notice of our readers, to convince them of the necessity of acquiring accurate chemical knowledge, and to leave it open to ourselves to speak of it as it deserves. We have no de-

sire to see human beings sacrificed to any theory whatever. We are not sorry that Mr. Hodgson was acquitted; for even supposing that he was guilty, his conscience will be punishment enough without any vindictive interference on the part of society; but it is of essential importance that the attention of medical men and young chemists should be directed to what can be proved by evidence on such occasions and what not, and that they, when called upon, should know how to enlighten a jury.

THE SALT MINES OF WIELICZKA.

Near Cracow, in Poland, are the celebrated salt mines of Wieliczka; of them the following account has lately been given by a traveller:—

"Notwithstanding the length of time during which these mines have been worked, and the quantity of salt taken out of them, their treasures appear to be as great as ever. They are situated in the outskirts of the Carpathians, a much finer range of hills to the eye than the Silesian mountains of the Giant, although they do not present, in this direction, any very elevated summits. The mines descend to the depth of about 1,500 feet, and though the miners go down on ladders by an ordinary shaft, the visitor has the accommodation of salt stairs, as ample and regular and convenient as if they had been constructed for palaces; and below the immense caverns, which have been formed by the removal of the salt, are, in many instances, connected with passages, equally smooth and spacious as the streets of a capital. The finest of them have been named after monarchs, because they have generally been, if not formed, yet widened into their present regularity and extent on the occasion of some imperial or royal visit. Thus you have Francis-street, and Alexander-street, and the great stair-case itself was originally hewn for the accommodation of Augustus III., of Saxony and Poland. Another method of descending is to pass down the perpendicular shaft, through which the barrels, filled with salt, are brought to the surface. Towards the lower end of the rope a number of cross pieces of wood are firmly secured to it, the groups being separated from each other a distance of seven or eight feet. A couple of strangers seat themselves in this strange machine, clasping the rope in their arms, with their legs hanging down into the dark and deep abyss. They are then lowered till the next pair of cross sticks is on a level with the mouth of the shaft; on these a second couple is seated in the same way, and thus it goes on till the supply of visitors is exhausted or the rope is sufficiently loaded for its strength. The rope and its burthen are then allowed to drop slowly into the earth, the windlass above being stopped on a given signal as each party reaches the bottom, to give them time to dismount from their wooden horses. At the very end of the rope are two little boys with lights to afford the passengers the means of preventing the vibrations of the rope from dashing them against the walls of the shaft. Although not the securest mode of travelling, there is not much danger if care be taken (and the workmen are very attentive) to prevent the descent from being too rapid, for in this case, the rope immediately begins to twist, and the feeling becomes extremely unpleasant. You are landed below at the depth of 300 feet, in the first floor, near St. Anthony's chapel, an early production of the miners. The chapel itself, its pillars, with their capitals and cornices, its altar, and its images, are all hewn out in the salt rock. It is not true, however, as has often been stated, that the outlines of its different forms have retained their original accuracy, and its angles their sharpness. They have all suffered, as was to be expected from the long continued action of moisture, which is abundantly visible in every part of the chapel. The angles of the walls

and the capitals of the pillars are entirely rounded away, and even St. Anthony himself, a very tolerable statue considering the artist and the materials, has been almost deprived of his nose, the most unseemly of all failings in canonized sanctity. In fact, Wieliczka has been the subject of much exaggeration. It is not true that the miners have their houses and villages beneath ground, that some of them have been born there, and that still more of them have never been on earth since they first descended; for, though the labour is carried on without interruption during the four-and-twenty hours, the workmen here, as in most other mines, are divided into three bands, each of which works only eight hours, and their houses, wives, and families are above ground. It is true that the horses employed in removing the barrels of salt from different parts of the mine to the mouth of the shaft, through which they are drawn up, rarely revisit daylight after they have once descended, and that they have their stables and hay lofts below ground; but it is not true that they generally become blind from living so much in the dark. The often repeated wonder of a stream of fresh water flowing through the salt rock is equally void of foundation; but neither is it true that all the fresh water in the mine is brought down artificially from above. There are some springs of fresh water, but there is no reason to suppose they even touch the salt rock. In Wieliczka the wood used in the mine is as hard as rock. I was assured that even animals which die there do not putrify, but merely assume the appearance of stuffed birds and beasts; and it was added, that when, in 1696, the bodies of some workmen who, it was supposed, had perished in the great conflagration, were found in a retired and deserted corner of the mine, they were as dry and hard as mummies.

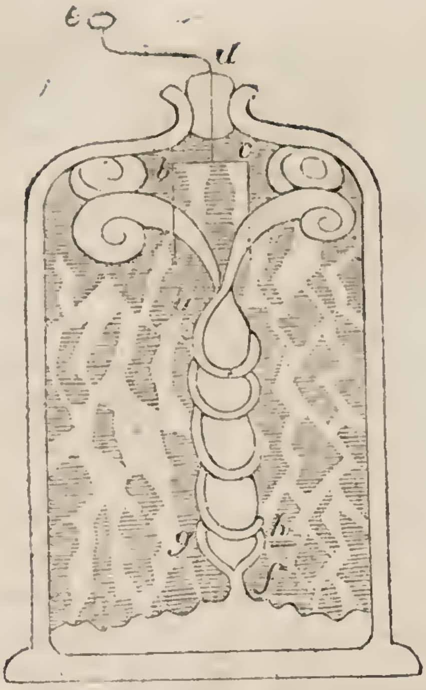
"In the deeper galleries the operations have been carried on with much greater care and regularity. In them the salt assumes more decidedly the character of a continuous stratum, although it is often interrupted, both vertically and horizontally, by veins of rock. The salt is cut out from long narrow blocks, as if from a quarry; it is then broken into smaller pieces and packed up in barrels. At certain distances masses of it are left standing to act as pillars in supporting the roof. Its colour, in the mass, is dark, nor is the reflection of light from its surface at all so dazzling as has sometimes been represented. When, indeed, flambeaux are flashing from every point of the rock, and the galleries and caverns are illuminated, as they sometimes have been in honour of royal personages, then crystallized walls and ceilings may throw back a flood of light, but in their ordinary state, illuminated only with the small lights, by the guidance of which the miners persue their labours, the effect is neither very brilliant nor imposing.

PREPARATION OF BORAX IN PERSIA.

CRELL'S *Annalen* for 1791, describes this as follows:—The water of an alkaline spring, which is hardly an inch in diameter, is collected in marble basins, and thence is conveyed into untinned copper kettles, where it is mixed with blood, urine, and scrapings of leather, and allowed to putrify for five or six weeks. The deposit at the bottom of the kettle is then boiled with water, and on cooling, a rude but not crystallized species of borax, called by the Persians bora, is obtained.

FORMATION OF AMMONIA.

M. CHEVALLIER has informed the Institute of France, that during the oxidation of iron by the contact of air and water, ammonia is formed; which seems to show, that the metal takes oxygen both from the air and the water, while the two other principles of these two compounds, viz. azote and hydrogen, unite and form ammonia.



TO MAKE WATER-SPOUTS.

Mr. Editor,—As you were so obliging as to insert my late communication immediately, I herewith send you another. The following is the manner in which the boys of my country, who, you know, are very studious and philosophical, make water-spouts.—Take a piece of fresh burnt lime, and throw it, while it is hot, into water; when it has fallen to powder, stir it about, and pour the whole into a cylindrical glass vessel, with a cork, as at *d*. Thrust a thin iron wire through the cork, and bend it both above and below at right angles. It is not to descend quite to the middle of the vessel. On turning the wire round by means of the upper part, *e*, the under part also describes a circle in the water as seen at *b c*, and gives the water a similar motion. After a little the lime at the bottom begins to move; if it has been well settled, and the wire is not turned round too quick, the lime gathers itself into a heap immediately under the wire, and a small round column arises to the top. If the motion of the wire be continued, part of the lime falls again to the bottom, and winds round the centre column something like a corkscrew, as seen in the little drawing I send you; or rather like a hollow pillar with a descending spiral thread around it. In the centre there appears to arise a finer dust in a spiral form, till it reaches the wire at *a*, when it spreads itself out in two horizontal branches, and has the appearance of four distinct whirlpools, two of each moving in different directions. Below, the column appears to have only one base, as at *f*, which almost immediately branches off into two, as at *g* and *h*. The whole column waves backwards and forwards, precisely as travellers describe water-spouts to do, and, like them, it spreads itself out under the top of the glass, as they spread themselves into the clouds.

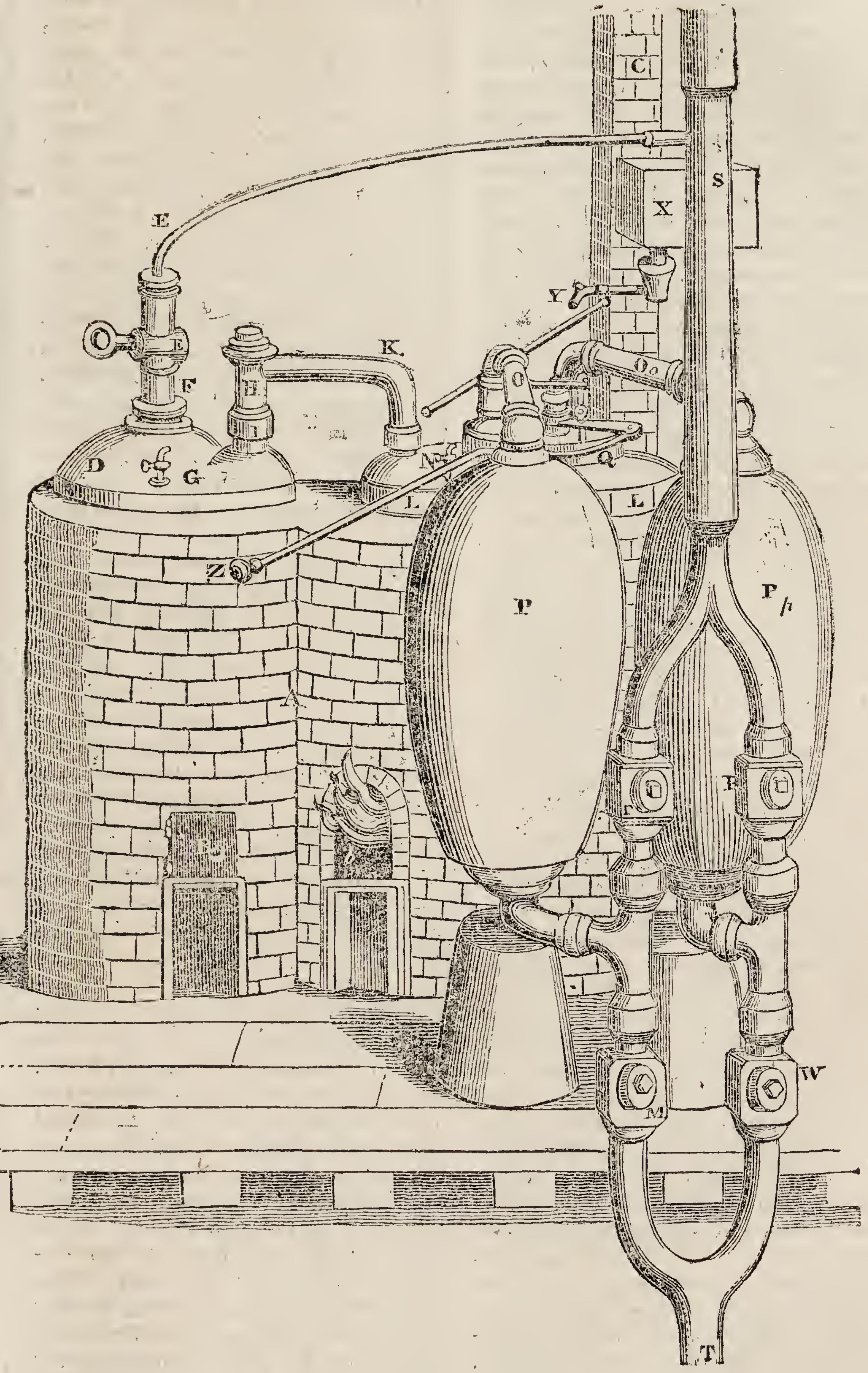
Your former Correspondent,
Ein Deutscher.

SUBNITRATE OF BISMUTH,

A substance now for the first time introduced in the Pharmacopœia, and said to possess great antispasmodic powers, and to be especially serviceable in those forms of dyspepsia which are attended with painful contractions of the stomach. To prepare it, take of bismuth an ounce, nitric acid a fluid ounce and a half, distilled water three pints; mix six fluid drachms of the distilled water with the nitric acid, and dissolve the bismuth in the mixture; then filter the solution, add the remainder of the water to the filtered fluid, and set it by, that the powder may subside. Lastly, having poured off the supernatant fluid, wash the submuriate of bismuth with distilled water, and dry it, wrapped in bibulous paper, with a gentle heat.

TO BREATHE FIRE.

Isolate electrically a large shallow dish, and then electrify the water strongly. If while this is going on, a person, having wetted his mouth, breathes towards the water, standing about a foot from it, he will to the spectators have the appearance of breathing fire, and may, if he be so disposed, play the devil Zamiel, in the Freyschütz, or persuade the credulous that he is a magician.



HISTORY OF STEAM ENGINES.

We propose, in this second Article on Mr. Stuart's book, to take from it a short and condensed account of the history of the steam-engine. It is now obvious, that steam may be employed in two distinct manners to produce power or give motion. As it is generated by the action of heat or water, it has a tendency to expansion, which

is so striking, that it must have very early attracted attention. To direct this power by making steam flow through pipes or apertures, is the first and most obvious method of employing steam. Steam only requires to be sufficiently cooled to be again condensed into water, then-occupying between 18 and 19 hundred times less space than when it existed as steam. Wherever this condensation takes place, the atmosphere has a tendency proportioned to its own weight, to rush in and supply the vacancy left by the water occupying so much smaller a space than the steam. The weight of the atmosphere, therefore, forcing it into the place left vacant, is the second mode in which steam may be employed in producing power. The effects of both these modes may be united, and applied in different manners, and directed to various objects. The former is the more obvious and simple; the latter, even if discovered ever so early, could scarcely have been put to any good practical purpose, without that general knowledge of the atmosphere, which was not acquired till the 17th century. It was the former, therefore, which was first employed, and the various adaptations which it underwent, employing the second mode by itself and uniting it with the other; and their different adaptations, each of which has had one or more inventors, have given rise to a number of conflicting claims for the honour of having invented the whole steam-engine. By shortly tracing the progress of this invention, we shall show that, like every discovery of great benefit to the human race, it was not the production of one person, but of the general knowledge of society.

The first person of whom any notice is preserved as having employed steam as a moving power, was Hero the elder, a Greek, who flourished about 130 years before the Christian era. The mode in which he generated motion by steam is not, however, the most simple. By making steam pass out of two opposite tubes of a hollow globe suspended on two pivots, the end of each tube being bent horizontally, the globe receives, by the resistance the steam meets on passing into the atmosphere, a whirling motion, which is continued as long as the steam is generated. From that time to 1002 we find no notice of steam as a moving power. Under this date, however, (says the Editor of the Mechanic's Magazine) we find, in William of Malmesbury's History, mention is made of "an hydraulic organ at Rheims, in which the air, escaping in a surprising manner, *by the force of heated water*, fills the cavity of the instrument, and the brazen pipes emit modulated tones." In 1536, the next time steam-engines are known to be alluded to, one Mathesius, in a volume of sermons, entitled "Sarpeta," hints at the possibility of constructing an apparatus similar to a steam-engine. Thirty years afterwards, a *whirling æolipile* was described in a book printed at Leipsic. It is the same as Hero's machine, and was probably copied from his description. It is recommended, however, by the moderns, as exceedingly well adapted to the purpose of turning the spit for the cook; it eats nothing, and gives withal an assurance to those partaking of the feast, that the haunch has not been pawed by the turnspit for the pleasure of licking his unclean fingers. In 1615, Solomon de Caus published a book, in which an engine for forcing up water by the *elasticity* of steam is described. This was said to be effected by heating water in a vessel provided with two tubes, one of which was for the admission of water, and the other, which descended nearly to the bottom, was for the emission. When the water was heated, the expansion of the vapour on the surface of the water forced it up the tube at the bottom of the vessel.

Giovanni Branca, an Italian mathematician, who resided at Rome in the beginning of the 17th century, directed a stream or jet of steam, issuing from a narrow aper-

ture, on a wheel formed with float boards, and revolving on its axis, like a water-wheel. The steam operated so powerfully on it that it was employed by some intermediate mechanism to give motion to the stampers of a mill for pounding drugs. After this period the power of the elasticity of steam to raise water was employed in a variety of modes by water-work artists, who were then much in vogue; but none of them seem to have had much influence in promoting the further use and improvement of the steam-engine. From a passage in Bishop Wilkins's Mathematical Magic, published in 1648, there is some reason to believe Branca's mode of supplying steam was then known and practised in England. In that famous book called the Century of Inventions, published in 1663, the Marquis of Worcester claims for himself the honour of having invented an admirable and forcible way of drawing up water by fire. Nobody has, however, been able to make a machine from the marquis's description. Mr. Stuart is rather inclined to treat this gentleman as having been somewhat of a quack, and, considering what he has borrowed from others, to have no claim to the honour often bestowed on him, of having invented the steam-engine. In 1682, Sir Samuel Morland had a scheme for raising water by the force of steam; but no description of his apparatus or its principle is known to be in existence. He was the author, however, of some experiments on the expansive power of steam, which must have been made with considerable care. Dr. Denis Papin, the undoubted inventor of a digester bearing his name, and of safety valves, seems to have been the first person who thought of creating a vacuum by the means of condensing steam, and employing that as a moving power. This thought, though thrown out in 1695, was not carried into execution; and in 1702, Captain Savary, a seafaring gentleman, introduced, in a work called the Miners' Friend, his engine to public notice. Of this engine, which was undoubtedly the first steam-engine, properly so called, we shall, by the permission of Mr. Stuart, present our readers with a representation, and a detailed description:—

"The first thing," says the ingenious inventor, "is to fix the engine in a good double furnace, so contrived that the flame of your fire may circulate round, and encompass your two boilers, as you do coppers for brewing. Before you make any fire, unscrew G and N, being the two small *gauge pipes* and cocks belonging to the two boilers, and at the holes fill L L, the great boiler, two-thirds full of water, and D, the small boiler, quite full; then screw in the said pipes again as fast and as tight as possible. Then light the fire at *b*, and when the water in L boils, the handle of the regulator, marked Z, must be thrust from you as far as it will go, which makes all the steam rising from the water in L pass with irresistible force through O into P, pushing out all the air before it through the clack *r*, making a noise as it goes; and when all is gone out, the bottom of the vessel, P, will be very hot. Then pull the handle of the regulator to you, by which means you stop O, and force your steam through O *o* into P *p*, until that vessel has discharged its air through the clack, R, up the force-pipe, S. In the mean time, by the *steam's condensing* in the vessel, P, a vacuum or emptiness is created, so that the water must and will necessarily rise up through the sucking-pipe, T, lifting up the clack, M, and filling the vessel, P.

"In the mean time, the vessel, P *p*, being emptied of its air, turn the handle of the regulator from you again, and the force is upon the surface of the water in *p*; which surface being only heated by the steam, it does not condense it, but the steam gravitates or presses with an elastic quality like air, still increasing its elasticity or spring till it counterpoises or rather exceeds the weight of the water ascending in S, the forcing-pipe, out of which the water in it will be immediately discharged when once gotten to the top, which takes up some time to recover that power; which having once got, and being in work, it is easy for any one that never saw the engine, after half an hour's experience, to keep a constant stream running out the full bore of the pipe. On the out-

side of the vessel, you may see how the water goes out as well as if the vessel were transparent; for as far as the steam continues within the vessel, so far is the vessel dry without, and so very hot, as scarce to endure the least touch of the hand: but as far as the water is, the said vessel will be cold and wet where any water has fallen on it, which cold and moisture vanishes as fast as the steam in its descent takes place of the water; but if you force all the water out, the steam, or a small part thereof, going through R, will rattle the clack, so as to give sufficient notice to pull the handle of the regulator to you, which, at the same time, begins to force out the water from P*p*, without the least alteration of the stream; only sometimes the stream of water will be somewhat stronger than before, if you pull the handle of the regulator before any considerable quantity of steam be gone up the clack, R; but it is much better to let none of the steam go off, (for that is but losing so much strength) and is easily prevented by pulling the regulator some little time before the vessel forcing is quite emptied. This being done, immediately turn the cock or pipe, Y, of the cistern, X, on P, so that the water proceeding from X through Y (which is never open but when turned on P, or P*p*, but when between them is tight and stanch)—I say, the water falling on P, causes, by its coolness, the steam, (which had such great force just before, from its elastic-power, to condense, and become a vacuum or open space,) so that the vessel, P, is, by the external air, or what is vulgarly called suction, completely refilled, while P*p* is emptying. Which being done, you push the handle of the regulator from you, and throw the force on P, pulling the condensing-pipe over P*p*, causing the steam in that vessel to condense, so that it fills while the other empties. The labour of turning these two parts of the engine, viz. the *regulator* and *water-cock*, and tending the fire, being no more than what a boy's strength can perform for a day together, and is as easily learned as their driving of a horse in a tub-gin; yet after all, I would have men, and those too the most apprehensive, employed in working the engine, supposing them more careful than boys.

" In case it should be objected, that the boiler must in some certain time be emptied, so as the work of the engine must stop to replenish the boiler, or endanger the burning out, or melting the bottom of the boiler. to obviate this, when it is thought fit by the person tending the engine to replenish the great boiler, which requires an hour and a half or two hours' time to the sinking of one foot of water, then, I say, by turning the cock, E, of the small boiler, D, you cut off all communication between the great force-pipe, S, and the small boiler, D, by which means D grows immediately hot, by throwing a little fire into B, and the water of which boils, and in a very little time it gains more strength than the great boiler; for the force of the great boiler being perpetually spending and going out, and the other winding up or increasing, it is not long before the force in D exceeds that in L; so that the water in D, being depressed by its own steam or vapour, must necessarily rise through the pipe, H, opening the clack, I, and so go through the pipe, K, into L, running till the surface of the water in D is equal to the bottom of the pipe, H. Then, steam and water going together, will, by a noise in the clack, I, give sufficient assurance that D has discharged and emptied itself into L, to within eight inches of the bottom; and inasmuch as from the top of D to the bottom of its pipe, H, is contained about as much water as will replenish L one foot. Then you open the cock, I, and re-fill D immediately, so that here is a constant motion, without fear or danger of disorder or decay. If you would at any time know if the great boiler be more than half exhausted, turn the *small cock*, N, whose pipe will deliver water, if the water be above the level of its bottom, which is half way down the boiler; if not, it will deliver steam. So, likewise, it will show you if you have more or less than eight inches of water in D, by which means nothing but a stupid and wilful neglect, or mischievous design, carried on for some hours, can any ways hurt the engine. And if a master is suspicious of the design of a servant to do mischief, it is easily discovered by these *gauge-pipes;* for if he come when the engine is at work, and find the surface of the water in L below the bottom of the gauge-pipe, N, or the water in D below the bottom of G, *such a servant deserves correction:* though, three hours after that, the working on would not damage or exhaust the boilers. So that, in a word, the clacks being, in all water-works, always found the better the longer they are used; and all the moving parts in our engine

being of like nature, the furnace being made of Stourbridge or Windsor brick or fire-stone, I do not see it possible for the engine to decay in many years; for the clacks, boxes, and mitre-pipes, regulator and cocks, are all of brass, and the vessels made of the best hammered copper, of sufficient thickness to sustain the force of the working the engine. In short, the engine is so naturally adapted to perform what is required, that even those of the most ordinary and meanest capacity may work it for some years without its receiving any injury, if not hired or employed by some base person on purpose to destroy it."

(To be continued.)

MUSICAL BAROMETER.

A GENTLEMAN at Burkli, by the name of Ventain, not far from Basle, in Switzerland, invented, some years ago, a sort of musical barometer, which has been called in German, *wetter harfe*, weather harp; or *riesen harfe*, giant harp, which possesses the singular property of indicating changes of the weather by musical tones. This gentleman was in the habit of amusing himself by shooting at a mark from his window, and that he might not be obliged to go after the mark at every shot, he fixed a piece of iron wire to it, so as to be able to draw it to him at pleasure. He frequently remarked that this wire gave musical tones, sounding exactly an octave, and he found that any iron wire, extended in a direction parallel to the meridian, gave this tone every time the weather changed. A piece of brass wire gave no sound, nor did an iron wire extended east and west. In consequence of these observations a musical barometer was constructed. In the year 1787, Captain Haas, of Basle, made one in the following manner: Thirteen pieces of iron wire, each 320 feet long, were extended from his summer-house to the outer court, crossing a garden. They were placed about two inches apart; the largest were two lines in diameter, the smallest only one, and the others were about one and a half. They were on the south side of the house, and made an angle of 20 or 30 degrees with the horizon. They were stretched and kept tight by wheels for the purpose. Every time *the weather changes*, these wires make so much noise that it is impossible to continue concerts in the parlour, and the sound sometimes resembles that of a tea-urn when boiling, sometimes that of an harmonica, a distant bell, or an organ. In the opinion of the celebrated chemist M. Dobereiner, as stated in the *Bulletin Technologique*, this is an electro-magnetical phenomenon. Do any of our readers know of such an instrument having ever been tried in Britain?

QUERIES.

THE best mode of dyeing quills different colours?

BY what process, or by what preparation can I effect the removal of stains in marble, called iron-moulds, *without cutting* or damaging it, so that it shall re-assume its original appearance?

ANSWERS TO QUERIES.

To the Editor of the Chemist.

As I can kill two birds with one stone, I beg to inform R. S. F., in answer to his Query in No. XXII., of the best mode of making chemist show colours.

Purple: Solution of nitrate of copper liquor, ammonia and water.

Yellow (very beautiful): Cambogia and spirit of wine.

Green: Infus. red cabbage and liq. potass sub. carb.

Blue: Solution of sulphate of copper in nitric acid and compound spirit of ammonia.

Black: Strong infusion of galls with sulphate of iron.

Red: Solution of oxalic acid one part, eight parts of distilled water, with some black ink.

Or, Cochineal and diluted salpt. acid.

Olive Green: Prussiate of lime with acid muriate and aq. distillat.

H. R. W.

Sir,—Of all your friends, admirers, correspondents, constant readers, &c. there are none who ought to feel themselves more indebted to you than those who so often trespass on your good nature in the character of querists. The ready insertion you give to their productions is a proof of your disposition to oblige, but I cannot help fearing that a continuation of your courtesy in this respect, will be at the expense of your reputation. In No. 17, a very wholesale dealer in interrogatories, yclep't Juvenis, (his age must be his excuse,) wishes to be informed of "The cheapest method of obtaining acetate of tin;"—"would be glad to see an article on distillation, giving a description of the most approved stills and lutes;"—"wishes to know whether the sun is the primary or secondary source of light; if heat proceeds from the same source and in the same manner;" "what is the best method of obtaining carbonate of ammonia from the ammonia disengaged during the manufacture of coal gas; and the best method of obtaining sulphur from the native sulphuret of iron," &c. Now, is Juvenis quite so young, as to suppose he can obtain any really useful instruction by an answer to any of his queries? I will leave him to judge of the rest by giving him an answer to one. Sulphate of ammonia is first formed by adding sulphuric acid to the gas liquor. The chrystals are mixed with carbonate of lime, heat is applied, decomposition takes place, carbonate of ammonia is sublimed, and the residuum is sulphate of lime. Juvenis may depend upon this being the cheapest and best method at present known, and the one adopted by the manufacturers of the article at the present time. The next I shall notice is "Alpha," in No. 21, who very modestly wishes to be informed of the best method of preparing nitro-muriatic acid for the dyer's use, and the cheapest method of setting about the necessary erections for the same? This is one of the articles on which my very subsistence depends, but so little do I fear a competition with "Alpha," that his wishes shall be gratified. Nitro-muriatic acid is prepared by mixing muriate of soda (common salt) and nitrate of potash (saltpetre) in certain proportions, and, adding sulphuric acid, heat is applied, decomposition takes place, nitromuriatic acid is disengaged, and the residuum is sulphate of potash and soda. For the cheapest way of erecting the necessary apparatus, I must refer him to his potter, bricklayer, and iron-founder. Having answered both their questions, I must beg leave to ask Juvenis and Alpha what benefit they will derive from it, and why did they trouble you for information which almost every modern work on chemistry would have afforded them? The fact is, they are quite ignorant of the difference in value between theoretical and practical knowledge. If the former will satisfy them, they have now a proof of its cheapness, in having procured it by merely asking for it: if the latter be required, they will soon find out its superior value, by the trouble and labour it will cost them in its acquisition. So much for your querists: and now, Mr. Editor, allow me to ask, to what clever and ingenious correspondent are we indebted for the long and scientific article in your last week's Number, on the manufacture of borax? You will find, upon inquiry, that the manufacture of borax has been carried on to a considerable extent in this country for many years, and long before the existence of boracic acid in a natural state was known.*

Your obedient servant,

Observator.

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* Our intelligent Correspondent, we believe, as well as another, who addressed us on the same subject, confounds, in the latter clause of his communication, the purification with the manufacture of the salt. We know that the crude borax brought from the East has for a long period been refined in this country; but we cannot believe that the salt was manufactured before the means of procuring the acid were known.—Ed.

DICTIONARY OF CHEMISTRY.

CALAMINE, *native carbonate of zinc*, employed to make brass.

CALCAREOUS ACID, *carbonic acid gas*.

CALCAREOUS EARTH, *lime stone*.

CALCEDONY, *blood stone*. A mineral called by the latter name from its colour, and by the former from having been found at Calcedon, in Asia Minor.

CALCANTUM. An old name for *sulphate of iron, copperas*.

CALCINATION means exposing substances to strong heat, with a view to drying or purifying them; the substance calcined being what remains.

CALCIUM. The metallic base of lime, discovered by Sir Humphrey Davy.

———, CHLORIDE OF, *muriate of lime, fixed ammonia*.

———, OXIDE OF, *lime*.

CALCSINTER. A name for the *stalactitical carbonate of lime*, which is formed by the continual filtration of lime-water through the crevices of caverns.

CALCTUFF. Another species of carbonate of lime, of a soft nature, which is probably deposited by calcareous springs.

CALCULUS, *stone*. The name given to the stony concretions found in various secretions of animals. Thus there are urinary, biliary, and arthritic calculi. The former are the cause of one of the most painful diseases to which man is subjected. They have been frequently analyzed, and found to consist chiefly of lithic or *uric* acid. The latter are those which form in the joints of gouty persons, and which are also found to consist principally of lithate of soda.

CALOMEL, *chloride of mercury, mild muriate of mercury, submuriate of mercury*. A well-known medicine.

CALORIC. The name given to the unknown cause of the sensation of heat in us, and of the expansion of bodies. It is supposed to be a fluid of unappreciable tenuity, endowed with we know not how many properties; but true philosophy rejects all suppositious existences, and confines itself to observing and recording facts, noting their similarity to one another, and their various relations. By doing this we gradually discover what may be called classes of phenomena, the subordinate parts of which, from their similarity one to another, are arranged together; while, from some dissimilarity, the classes are kept apart. We may, without any impropriety, give a name to the supposed cause of the similarity in the subordinate facts, and of the difference in the classes; but we should always remember that such names are merely verbal helps to memory, and do not, independent of the assistance they thus afford, advance us one step beyond the phenomena we witness. In this point of view, we have no objection to the term *caloric* standing for the unknown cause of our sensations of heat, the expansion of bodies, and the change in colour which frequently accompanies the expansion, as these effects frequently take place, though not always, simultaneously. There is, however, no resemblance whatever between these effects, and perhaps it is a false philosophy to ascribe to *one* unknown cause things so very different. If, indeed, at the moment we feel the sensation of heat, there were some one substance always present, which we could at the same time see, grasp, and weigh, there might be some better ground for applying to it the name of caloric; but when this is not the case, we must be cautious not to suppose we have advanced in knowledge by the invention of a term. We say that such inventions explain nothing; and after using the name, and supposing a fluid or a motion, we are just as much at a loss as before in conceiving how this, which itself *takes up no space*, and which has no sensations, can *expand bodies*, or excite the pleasureable feeling of heat.

MAGNESIA AND OIL.

CALCINED magnesia has the property, if rancid oil be heated with a quantity of it, completely to destroy the rancidity of the oil.

A WOMAN COVERED WITH MITES.

It is common enough in old cheese to find numerous mites, and the following seems a well-authenticated instance of an unfortunate female who was in this respect like a cheese:—"A woman about forty years of age, after having been ill for twenty years, and whose re-establishment was given up, placed herself under the care of a physician, who promised to cure her by a violent remedy. In fact, after a short time, she felt considerably better, but was much troubled with a severe itching over her whole body. Judge of her surprise, on observing, whenever she scratched herself, that thousands of little brown animals, almost imperceptible, issued from beneath the skin. These animals, on being examined by M. Bory St. Vincent, a living author of reputation, and whose veracity is above suspicion, by means of a microscope which magnified 500 times, were found to be of the genus *acarus*, and closely allied with the species *ixodes*, but there were differences sufficient to entitle him to call them a new species. The unfortunate woman, who gave birth to them in thousands, particularly in warm weather, did not communicate any of this troublesome progeny to those who attended her, nor even to her husband, who continued to live with her. The improvement of her health did not last long, and she died in consequence of the irruption of these microscopic *acarii*." A plate, representing the woman's case, was subjoined by M. Bory St. Vincent, to the memoir which he presented on this subject to the Institute of France, in the Transactions of which Society, for 1823, this extraordinary case is recorded.

TO REFINE CAMPHOR.

Mix three or four parts of camphor with one part of quick lime, and then subject them to a moderate heat, when a beautiful white camphor may be obtained by sublimation.

TO CORRESPONDENTS.

There is something so marvellous in the communication of Anti-Chemicus, *that we must beg leave to decline inserting it.*

A Young Admirer of Chemistry, *who addressed us some time ago on the subject of balloons, is informed, that we have left for him at our Publishers', the address of a gentleman, who says he will give him all the information he requires.*

We conceive the now distinctly expressed doubt in the letter of A. Z., *"whether carbon, by simple juxtaposition with oxygen, unassisted by heat or electricity, would combine with it," a very rational one; but his mode of illustrating his statement does not bear on the question. If he can show that carbon will under no circumstances combine with oxygen but at a red heat, the dilemma he has put would be a correct one; at present, Dr. Edwards would find a hundred ways of escaping from it. In our few observations, we did not affirm that the juxtaposition caused the union; but we asked, why not suppose it, as well as suppose it was effected by some nervous energy, the very existence of which is not fully proved? If, as Sir H. Davy states, "chemical and electrical changes are identical, depending on the same properties of matter," and if, as our Correspondent supposes, the nervous energy* is electrical, *there can be no possible objection to supposing the union is effected by electricity; but then there is no difference of opinion, only a different mode of expression. On the whole, we do not think it requisite to publish the letter of* A. Z.

Philo-Chemicus *stands over for consideration.*

We are obliged, by circumstances, to postpone for the present week the Articles on Chemistry *and* Distillation.

A. B.'*s request has been attended to.*

*** *Communications (post paid) to be addressed to the Editor at the Publishers'.*

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The Chemist.

"——Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if nought in these external scenes
Can move thy wonder?——"

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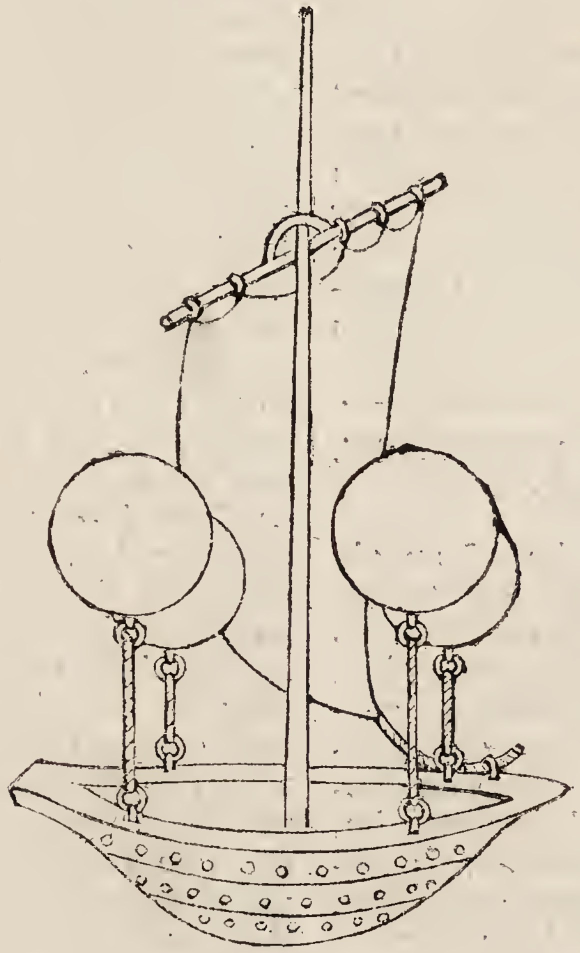


CONTENTS.

LANA'S BALLOON.

To the Editor of the Chemist.

Mr. Editor,—In looking over some old books a few days ago, I found the following little account of a very early attempt to construct balloons. If you think it worth inserting in your miscellany, with the illustrative drawing, it is at your service.

Yours, obediently,
Black Letter.

"Lana was an Italian Jesuit, living, we believe, in the north of Italy, and in 1670 published a book at Brescia, under the title *Prodromo dell Arte Maestra*, in which he describes, or rather dreams of a boat, having a ball of copper, twenty feet in diameter, the substance of which was to be 1-68th of a line thick, fixed at to each corner. His boat was have a mast and sail, but how she was to be raised does not appear, for his scheme of exhausting the air of the balls would not answer the purpose. Gallien, who published, in 1755, *L'Art de Naviger dans les Airs*, seems to have dreamt more scientifically than Lana, for he proposed to construct a machine of linen, covered with wax and tar, the belly of which was to be filled with air lighter than the atmosphere. From such imperfect beginnings did the present science and art of aerostation arise."

CHEMISTRY AS A SCIENCE.

Art. XXIV.

It is an old maxim of an old system of philosophy, that bodies cannot act where they are not. So far was this maxim once carried, that it was supposed absolute contact was necessary for one substance to have any effect on another. The error of this maxim, thus generally expressed, is obvious from magnetic attraction, and from gravity, by virtue of which, among numerous other effects, the far distant moon causes the flood and ebb of the tides of our ocean. This error is further obvious, from the well-known experiment of Sir Isaac Newton, who found that it required a very considerable force to bring two pieces of glass within a certain distance of each other, and that no force he could apply would bring them in contact, for before they absolutely touched each other, they were shivered to pieces. Thus we should rather be inclined to suppose that the reverse of this maxim is correct, and that we ought to say all bodies possess a mutual power of affecting each other at a distance, or their influence extends where they are not. It is probable, however, that this old maxim has still a very considerable influence; and even those philosophers who deny it when thus stated, seem to adopt it as the principle of their logic. Thus, in the first example we quoted, the magnetic influence operating at a distance has been explained by the intervention of a fluid, and there have been numerous attempts to account for the laws of gravity, by referring it to some elastic ether. We believe the same error has had considerable influence on most of the theories of light. There being a difficulty in explaining how men see, it was supposed that a subtle fluid was dispersed from every point of luminous bodies, bearing with it their form and features, and entering the eye, imprinted their representation on the retina, causing in us sensations of sight.—Admitting all this, though there are some facts which cannot be explained by this theory, such as seeing objects single with both our eyes, and the image being inverted on the retina, while the sensation is the right side upwards, if we may so express it; still, as the image goes no further than the retina, and there is no vision without the optic nerve and the brain, it must be supposed that the action of light proceeds to the latter, and there is as great a difficulty to get over at the end of the supposition as before it was made. Conceiving, therefore, that nothing is gained by supposing vision to be produced by a substance entering the eye, or by the undulations of a fluid, the theory of some philosophers, we shall, under this division of the subject, merely state such facts concerning light as have any connexion with chemistry, without at all entering into any discussions as to what causes sensations of sight, and whether it is a distinct substance, or whether there is some generally diffused ether, the vibrations of which produce vision,

while some other motions of it produce gravity, electricity, and all other phenomena.

No definition can, in our view of the matter, be given of light; what the term stands for in ordinary language is known to every man; and the wisest philosopher may confuse the reader by explanations, but cannot make him more sensible of what light is, than by referring him to his own knowledge. Every person not blind knows what is meant by the light of the sun, the light of a candle, or of any other burning body. Within any distance that we are capable of measuring on the earth, there is no perceptible interval between the moment of illuminating an object and that object being perceived. Thus in the experiments frequently made on the velocity of sound, it is assumed that the perception of the flash of a gun is visible at the same moment to a man at a distance of ten miles as to him who fires the piece. From some astronomical observations, however, it has been concluded that an interval elapses between the rising of the sun and the perception of that rising on the earth. Roemer, a Danish philosopher, was the first person who calçulated, by some observations on the satellites of Jupiter, that light traverses a distance equal to one half of the earth's orbit in about eight minutes, or that it moves at the rate of 200,000 miles in a second. His calculations have been strengthened by observations on what is called the aberration of the light of the fixed stars, and it is now a generally received opinion that light travels with this velocity, or requires a certain time to move through a certain space. As, however, *time* is itself measured by the motions of the heavenly bodies, it is possible that what is called the aberration of light, or its velocity, is produced by some uncalculated motion of the planetary system. We give no opinion on so abstruse and conjectural a point of philosophy, but merely hint at the fact of time itself being measured by the motions of the planetary system as possibly serving to explain the astronomical phenomena mentioned, without assuming that light is a substance projected from certain bodies with indefinite degrees of velocity. In most systems, however, light is described not only as the cause of vision, but as moving with almost measureless rapidity, and as being endowed with a power of repulsion among its own particles.

A great number of appearances are explained by the refraction of light. Every body knows that when an oar or stick is partly plunged into water, it does not appear straight, as when wholly out of the water, but broken. This effect, as well as several others, is said to be caused by the refraction of light. The general fact is, that when transparent mediums of different density intervene between the seen body and the eye, that body is not seen in its proper place. As far as the sun is concerned, this effect is only observed when its rays pass obliquely from one medium to another of different density; and when they pass, into a denser medium, they are refracted towards, and into a rarer, from the perpendicular. The variation of the rays from the rectilineal path is always proportional to the obliquity with which they strike the refracting surface, so that the sine of the angle of refraction is always in the same proportion to the angle of incidence. In general the degree of refraction is proportional also to the density of the medium; but combustible or inflammable bodies are observed to occasion a greater deviation than others in proportion to their density. A knowledge of this fact led the illustrious Newton to conjecture, long before the diamond was burned and water decomposed, that they both contained a combustible material. The law that the degree of refraction is in proportion to the density of bodies, though long very generally accredited, has lately been shown, by Messrs. Arago and Petit, not to hold in all cases. When liquid

bodies are converted into gases, their refractive power diminishes in a greater proportion than their density. Thus the refractive power of sulphuret of carbon, while liquid, as compared to that of air, is more than 3, while its refractive power, when in a state of vapour, is only 2. Advantage has been taken of the refractive power of different substances to judge of their purity. Dr. Wollaston has invented an instrument for measuring the refraction of different substances, which has an index, so that the degrees are read off at once. It is, for example, stated, that the refractive power of genuine oil of cloves is 1.535, while it is found in commerce only 1.498, in consequence of its having been adulterated with some less refractive oil. In consequence too of the refractive power of different substances being a constant quantity, and in some measure an indication of their purity, tables are in general given, in chemical books, of the degree in which it is possessed by different substances. We do not think it necessary to give these tables, but shall content ourselves with observing, that no substance is equal to hydrogen in refractive power; it surpasses all other gases, and indeed all other known bodies. This principle exists in great abundance in oils, resins, and gums, united to charcoal and oxygen; and it seems to be supposed, with good reason, that the refractive power of the element exists still in the compound. The chemical properties of hydrogen, as well as of most other elementary bodies, are so modified by a union with other substances, that very often in the compound no trace can be found of the properties of either. But it seems different as to light; and the refractive power of two elements when combined seems equal to their refractive power when by themselves. Carburet of sulphur exceeds all fluid bodies in refractive powers, surpassing even flint glass, topaz, and tourmaline. Of solids, the diamond, realgar, and chromate of lead possess the greatest refracting powers.

The phenomena of the prism, and probably of colours in general, seem to be occasioned by the refractive powers of different substances. If a ray of light, admitted through a small hole of a window-shutter into a darkened room, be made to pass through a triangular prism and received on a sheet of white paper, the image or spectrum is found to be oblong, terminated with semicircular arches, and to consist of several colours. They are the following, and are arranged in the following order: red, orange, yellow, green, blue, indigo, and violet. If the whole spectrum be divided into 360 parts, the red, it was ascertained by Newton, would occupy 45, the orange 27, the yellow 48, the green 60, the blue 60, the indigo 40, and the violet 80. This effect is supposed to be a proof that light consists of seven distinct rays, each of which is more or less refracted than every other by the prism. As a further proof of this, it is observed, that if the rays separated by a prism be concentred on one spot by a lens, they will reproduce colourless light. This property of the different rays, to be more or less refracted, is called their refrangibility; and the red rays are least refrangible, the violet the most. The separation of a ray or beam of light into these different coloured rays, is undoubtedly a curious fact, more especially as each one of them has different characteristics and powers. Thus, according to Dr. Herschell's experiments, the *illuminating* power of the light green ray in the centre is greater than that of any other ray, and much greater than the illuminating power of the rays at either end of the spectrum. Thus, also, according to the experiments of the same philosopher, confirmed by the experiments of Sir H. Engelfield and M. Berard, each of the rays possesses a different heating power, the violet ray heating the least, and the red the most; while there was an unilluminated point beyond the spectrum, where the heating effect was almost equal to that of the red ray. Thus also

light has the property of deoxidizing substances, and it is found that the red ray deoxidizes least, and the violet most; and that even beyond the violet the deoxidizing effect is perceptible where there is no visible light. We are indebted for a knowledge of this effect to Dr. Wollaston, and his observations have been confirmed by M. Berard. He exposed different substances to each ray, and found that the chemical intensity, for this is a chemical phenomenon, was greatest at the violet end of the spectrum, and extended a little beyond it. Light, therefore, which appears on first inspection to be so simple, is found, when examined according to this theory, to consist of seven distinct substances, each of which possesses some properties to distinguish it from every other. Independent, then, of light producing vision, it produces heat, and it deoxidizes bodies. The other properties attributed to light, we shall describe in another Paper.

CHEMICAL SOCIETY.

We understand, from a copy of the regulations of this Society having been obligingly forwarded to us, that it was finally constituted on August 12th, and a set of rules agreed to. The Society is to consist of both ordinary and honorary members; to be governed by a president, a council, and other officers, who are to be annually elected; is to meet once a fortnight, and to have an annual meeting. The subscription, we observe, is to be, "at the entrance of each ordinary member, one guinea, and also the further sum of one guinea half yearly, to commence the second quarter day from the date of his entrance." "The object of the Society is the study of chemistry in all its branches." "The lecture-room and library of the Society are to be open from nine in the morning until ten in the evening, except Saturdays, when it is closed at three o'clock." "The ordinary meetings of the Society are to be occupied by the delivery of lectures in various branches of chemistry, by the reading of memoirs, by the performance of experiments, or by the discussion of any subjects connected with chemistry, as the council may direct and approve of." Visitors are to be admitted to the meetings, but must receive permission from the president to speak on any of the subjects discussed by the Society. We have not learned what number of members have joined the Society; but its object is so laudable, that we have no doubt it will be both numerous and respectable. We repeat our wishes for its welfare, and our offer to promote its objects by any means in our power.

ON THE COMPARATIVE VALUE OF OIL AND COAL GAS.

(*Abridged from the Edinburgh Philosophical Journal.*)

The author of this Paper, Dr. Fyfe, who is Lecturer on Chemistry at the School of Arts in Edinburgh, begins by stating, although much apprehension was excited on the first introduction of gas lighting, by the necessary large collections of an explosive gas, that only one gas holder has been blown up since the practice was generally introduced; and this took place at Manchester in the infancy of the art, and was occasioned by a workman applying a lighted candle to the part whence gas was issuing and mixing with atmospheric air. A few accidents have occurred by the gas escaping from the pipes, but these have also in general been owing to carelessness. Shops and apartments are not close enough to keep the gas confined; and even if they were, the quantity which can escape is too trifling, compared to the quantity of air in the apartment, to occasion any mischief. Coal gas is most explosive when mixed with about five parts of air. It would be therefore requisite, in a room which contains 1728 cubic feet, lighted by a stream of gas, consumed at the rate of five cubic feet in an hour, that the burner should be left open upwards of fifty hours before the mixture be-

comes explosive. When coal gas is used, its offensive odour gives warning of its escape; so that one of its most noxious qualities is a valuable safeguard.

THE INGREDIENTS FOUND IN OIL AND IN COAL GAS, when sent into the pipes for burning, and after both gases have been purified, are or ought to be the same, but they exist in somewhat different proportions. The following tables, the first by Dr. Henry, the second by Dr. Fyfe, show these different ingredients and their proportions. The gas is first subjected to the action of chlorine, which condenses a certain portion, supposed to be partly olefiant gas and partly a volatile oil.

Coal Gas.

The following table is the result of experiments, made on five kinds of coal gas, prepared from Wigan Canal Coal. The three first were collected from an opening in the pipe between the retort and the tar pit, half an hour after the commencement of distillation; No. 4 was taken five hours, and No. 5 ten hours after the beginning. The carbonic acid and sulphuretted hydrogen were removed by washing the gas with a solution of potassæ.

After being condensed by chlorine, 100 parts contained

Gas.	Specific Gravity.	Condensed by Chlrorine.	Azote.	Carburetted Hydrogen.	Carbonic Oxide.	Hydrogen.
No. 1	650	13 per cent.	1.5	94.5	4	0
2	620	12	6	82	2	10
3	630	12	2	66	14	18
4	500	7	5	60	12	26
5	345	0	10	20	10	60

Oil Gas.

The gas, Nos. 1, 2, 3, was procured from whale oil, previously boiled, to free it from water, the heat of the retort being reduced at each succeeding experiment, till it was just sufficient to decompose the oil.

After being condensed by chlorine, 100 parts contained

Gas.	Specific Gravity.	Lost by Chlorine	Azote.	Carburetted Hydrogen.	Carbonic Oxide.	Hydrogen.
No. 1	464	6 per cent.	7	30	15	48
2	590	19	5	40	15	40
3	758	22.5	5	65	20	10
4	906	38	5	75	15	5

The reader will see that, in the best specimen of oil gas, the carbonic oxide is in greater proportions than in the best specimens of coal gas, and in the latter the carburetted hydrogen is most abundant. The hydrogen in both appears to increase, as the temperature at which they are formed becomes higher, and is always greatest in the last portions.

THE QUANTITY OF GAS OBTAINED FROM COAL AND FROM OIL, varies according to the nature of the material and the manner of treating it. The author quotes from various writers the following statement of the quantity of gas obtained from two hundred species of coals:—

Wallsend, about	750 cubic feet
Parrot . . .	860
Lesmahago . .	1080
Newcastle . .	1080
Wigan Orral .	700
Cannel (doubtful)	1200

From which 1000 feet are taken as the average of the quantity of gas which ought to be obtained from good coal. The quantity of gas obtained from oil varies from 97 to 120 feet, whence it is stated, that 100 feet may be considered as a fair estimate of the quantity of gas usually obtained from a gallon of oil. Dr. Fyfe says, that if the oil be allowed to flow into a retort brought just to a red heat,

there is comparatively little gas, but a great deal of volatile oil. When the retort is made intensely hot, lamp black is formed in considerable quantities. In both these modes then the oil may be wasted to a considerable extent; and it seems to be decomposed most advantageously when the retort is brought to a full red heat.

The illuminating power of oil and coal gas has been differently stated by different persons. According to some, the power of the oil gas is as three and a half, the coal gas being one, while, according to others, it is only two, and even not greater. On this question, however, turns one which is of very great importance, whether oil or coal gas works are most advantageous; and we must, therefore, follow Dr. Fyfe more closely in this part of his work. He first throws doubts on some experiments of Mr. Ricardo's, and of other gentlemen, on account of their having been incorrectly made, while he seems disposed to admit the accuracy of the experiments of Messrs. Herapath and Rootsey, which do not give so high an illuminating power to oil gas. Mr. Dewey's experiments published in the Annals of Philosophy, last December, and which showed a great degree of illuminating power in oil gas, were made, it appears, as well as some other experiments, with coal gas of a very small specific gravity, only 406; and Dr. Fyfe contends, that the illuminating power of both gases, after being properly purified, is in proportion to their specific gravity. The oil gas Mr. Dewey used was 939, which is very good; and if (says Dr. Fyfe) a good oil gas is only three and a half times superior to a very inferior coal gas, its superiority must be much reduced when brought into competition with the latter, when of an equally good quality. Dr Henry proposed to ascertain the illuminating power of each gas by the quantity of oxygen necessary for its combustion, and, tried by this test, he obtained the following results:—

One hundred volumes of coal gas, of the

Specific Gravity,	Took of Oxygen,
345	78
500	166
620	194
630	196
650	274

One hundred volumes of oil gas, of the

Specific Gravity,	Took of Oxygen,
464	116
590	178
758	220
906	260

From this it appears, that the best oil gas is to the worst coal gas as three and a half to one, while the best of both stand in the relation to another of 26 to 21. On the theory, that the olefiant gas contained in both is the principal source of light, as this may be condensed by chlorine, Dr. Fyfe proposes this as a test of the illuminating power of each. The mixture must be excluded from light to prevent any action on the carburetted hydrogen. Dr. Fyfe recommends the following method for trying this experiment:—A graduated jar, inverted in a water trough, must be filled to 50 with the gas; 50 measures of chlorine must then be introduced, the tube being covered with a paper shade, to prevent any action on the other gases. In the course of from 10 to 15 minutes the condensation is complete; and as chlorine and olefiant gases combine in equal proportions, the diminution in the mixture indicates correctly the quantity of olefiant gas in the gas subjected to trial. This, Dr. Fyfe says, promises to be an accurate mode of ascertaining the comparative illuminating powers; and by this method he has found the oil gas prepared in Edinburgh to be to the coal gas as 31 to 17, or nearly 1.8 to 1. Dr. Fyfe, we see, admits that the other constituents of both gases possess some illuminating powers; and unless the proportion of these other ingredients were the same in both, we cannot see how his method can be any thing more than an approxi-

mation to accuracy. He concludes this part of the subject, however, by stating, "I suspect coal gas will be found to possess, or at least may be made in general to possess, about half the illuminating power of that from oil." He has found this to be the case with those made in Edinburgh, by producing the same quantity of light and marking the quantity of gas consumed.

He then enters into some calculations to show the cost of manufacturing oil and coal gas; but this depends on so many circumstances, that we cannot follow him. Having stated his opinion as to the quantity of light to be obtained from the two gases, we must leave it to the discretion of our readers to choose either, as they are so placed as to obtain the material at a dear or cheap rate. But though Dr. Fyfe thinks that, at present, oil gas cannot be made so advantageously as coal gas, he does not assert that it never can. "Oil gas establishments," he says, "are in their infancy; and as, by the present mode of decomposing oil, there is a considerable loss of illuminating power, other and more effectual methods of decomposing it may be discovered, which will allow it to be offered at a cheaper rate, and thus bring it into competition with coal gas, provided we consider it as having three times the illuminating power; but if, as I have endeavoured to show, it is only about twice that of coal gas, I fear it never can come into competition with it."

We observe that the Coal Gas Company of Edinburgh have lately employed Professor Leslie to make some experiments on the comparative illuminating powers of oil and coal gases, and they have published the results of his experiments, which nearly coincide with those of Dr. Fyfe. The Professor's experiments are, however, not yet finished; and when they are published we shall lay them at length before our readers.

TO FORM WATER.

To the Editor of the Chemist.

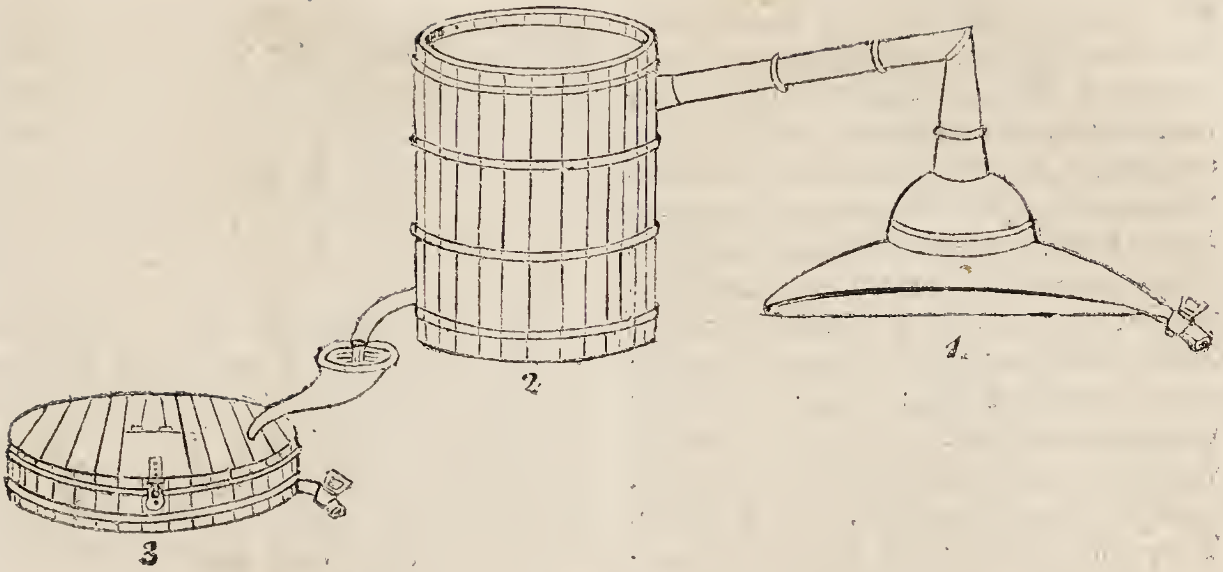
Mr. Editor,—You have lately shown your young readers how to decompose water; and I will, with your permission, point out to them how they may compose it of its two constituent principles. Let them supply themselves with a glass bottle, as seen in the little drawing I send herewith. It is to be provided with a cork, through which a small hole is pierced, and in this a glass tube is inserted. They must put into the bottle a small quantity of iron filings, and pour on this about twice as much sulphuric acid, by weight, previously diluted by about four times as great a quantity of water. After these substances are placed in the bottle, put in the cork and set fire to the gas, which is hydrogen, that will issue from the mouth of the tube. When this is done, invert over the flame a glass jar, as seen in the little drawing; and in a very short time its inside will be covered with a very fine dew, which is pure water, arising from the combustion of the hydrogen gas, produced from the materials in the bottle, and the oxygen gas of the atmosphere.

I am, Sir,

Your obedient servant,

A Student's Friend.

Bethnal-green, Aug. 28.



DISTILLATION.

Art. III.

FERMENTATION.

PERHAPS the most difficult part of the whole process of procuring a good spirit consists in making the materials from which it is to be extracted undergo a proper degree of fermentation. On this depends the quantity of spirit *formed* by the grain; the quantity extracted, indeed, will depend on what is properly called distillation. We know of more than one instance in which the results completely disappointed expectation, in consequence of the fermentation not having been completed. No spirit can be obtained from grain until it has been fermented; this part of the process is therefore essential, and it is necessary that its principles should be known.

It is a striking distinction between the substances belonging to the animal and vegetable kingdom, and minerals, that the former are subjected to perpetual alteration, while the latter, if left to themselves, remain almost unchanged, or change so slowly that the alteration is scarcely perceptible to our senses. Vegetables and animals, while living, grow and decay; and when dead, unless under very peculiar circumstances, invariably undergo spontaneous decomposition. Chemical researches have demonstrated, that during the lifetime of plants the substances of which they are composed are continually changing their nature. Mucilage in the young plant becomes starch in an old one, and the acid of the green fruit, as the season advances, is gradually converted into sugar. The constituent parts, then, of plants are gradually entering into new combinations and forming new compounds. This holds good after the plant has been taken from the earth and the fruit gathered from the tree. Our readers have all witnessed the change which a cabbage or some similar vegetable undergoes when taken from the ground; its leaves gradually decay: if thrown in a heap, and not exposed to some drying influence, they soon become moist, and after a short time emit a most noxious effluvia, a part of their constituents separating in the form of gas occasions an intolerable smell. This species of spontaneous decomposition is called putrefaction. On the other hand, when the odour is not offensive, when the products are applied to useful purposes, when the circumstances under which the process takes place are effected by art, though the decomposition may still be called spontaneous, the name of fermentation has been given to it. For a long period, the nature of these changes was involved in utter darkness; but since chemistry has been applied to analyze the substances found both in the living and the dead vegetable, and in the products of its decomposition, some light has been thrown on this curious phenomenon, though it cannot yet be described as perfectly known. As the ultimate

constituents of all vegetable matter are oxygen, hydrogen, and carbon, all the products of the fermentation of vegetable substances are merely new compounds of these three elements. Lavoisier was the first chemist who instituted a series of experiments on right principles to investigate the phenomena of fermentation; and since then the same subject has been pursued with considerable success, though with little alteration in the results, by M. Thenard and M. Gay Lussac. The phenomena of vegetable decomposition vary in some measure, according to the nature of the substance decomposed. With this variety we have, on the present occasion, nothing to do, but shall content ourselves with describing that change in vegetables, the result of which produces intoxicating liquors, and which is known by the name of *vinous* fermentation.

When the juice of grapes, which is called *must*, is expressed, and left in a temperature of about 70°, it soon becomes thick and muddy, its temperature increases, and carbonic acid gas is evolved; in a few days the fermentation ceases, a thick part subsides to the bottom, a scum rises to the surface, the liquid loses its sweet taste, becomes lighter, and is the substance well known under the name of wine. On analyzing *must*, it is found to consist principally of water, sugar, jelly, gluten, and tartaric acid, the quantity of sugar being very considerable, though varying in different grapes. Wine, however, is found to consist principally of an *acid*, *alcohol*, *extractive matter*, *a volatile oil*, which gives it its peculiar flavour, and a *colouring matter*. The alcohol obtained from wine by distillation, as it is found in commerce, in its diluted state, is called brandy. No alcohol can be detected in *must* before fermentation. Grain, whether malted or not, when infused in water at a certain temperature, undergoes a change like the fermentation of must, but the resulting liquid, though it contain alcohol, is not, without farther preparation, fit for use. We have at present nothing to do with that farther process, by which the malt, after being infused and changed into wort, is converted into beer; and shall strictly confine ourselves to describing the process which we understand to be used by the distillers.

In this country the distillers make use of both malt and grain, the proportion of the former varying from a third to a tenth part of the latter. This mixture is ground, or the malt is merely bruised and mixed with barley already ground to meal. To one bushel of this mixture from 12 to 13 gallons of water are added, at a temperature of about 150° Fahr., and the whole is subjected by mechanical means to considerable agitation, which constitutes the process of *mashing*. This is kept up for some time, and the heat preserved by the addition of seven or eight gallons of water, a few degrees under the boiling temperature. The infusion is called *wort*, is very sweet, but not quite so sweet, nor is it so clear, as that made from malt. The starch, therefore, of the grain seems to be converted by the mashing, as in the process of malting, to the nature of sugar. The wort, after being allowed to settle, is drawn off and cooled very rapidly, in extensive wooden troughs, or it is made to traverse a pipe immersed in cold water; more boiling water is then poured on the grain to extract all the saccharine matter possible. The portion of water which is poured the third time over the malt is generally reserved to be poured over fresh grain, or it is concentrated by boiling. It may be here remarked, that there is no species of manufacture which, on account of the taxes levied on it, has been so much restrained, impeded, and injured in this country by numerous and injudicious fiscal regulations as that of spirits. Fortunately for mankind, the love of gain has been too strong or too cunning for the wit of the legislator, and the art has been found of circumventing him, to the great benefit of the world. It is quite evident, if

a tax were laid on cotton cloth, which, for the sake of collecting this tax, prescribed that all the threads should be of one specific thickness, and all the webs of one specific strength, we could have none of that variety of texture by which every taste is now gratified, and every purpose answered by the products of our looms. Now the manufacture of spirits has been subjected to restrictions analogous to those we have supposed to be laid on cotton. Thus the distiller is obliged, as a consequence of the law, to make his wort of a certain specific gravity, and to obtain from that a certain quantity of spirit of a specific strength. We shall boldly assert, that this is the reason why, when our knowledge of the *chemistry* of distillation has been so extensively increased, the spirit manufactured in our country is, compared to that manufactured in other countries, inferior both in flavour and goodness; why, for example, common English gin is so decidedly inferior to good smuggler-made malt whisky and to the gin made in Holland. In this latter country the mode of levying the tax does not compel the manufacturer to concentrate his worts so much, nor to distil so rapidly, nor to make precisely such and such a quantity, or pay for it whether made or not; and hence he makes a liquor to suit the health and taste of his customers. Under a pretence of benefiting people, legislators restrict them to the use of a liquor which is both comparatively disagreeable and unhealthy. The mode in which the distillers strengthen their wort, is to add to it an almost saturated solution of barley and malt in hot water, till it has attained the requisite strength. It is calculated, that to obtain a gallon of spirits of the specific gravity of 0.91917, which contains 4.6lbs. of alcohol, 9.2lbs. of sugar must be decomposed. But as the distiller cannot count on decomposing above four-fifths of the saccharine matter of wort, he is compelled to raise the strength of his wort so that it may contain $11\frac{1}{2}$lbs. of saccharine matter for every gallon of spirits, which, whether made or not, he must pay duty for.

After the distiller has thus prepared and cooled his wort, it is run into the fermenting tub; the temperature is between 55° and 70°, according to the quantity, the season of the year, and the opinion of the distiller. Its specific gravity varies, being never less, we believe, than 1.060, and so great as 1.110. The best yeast which can be procured is added, in successive portions, during three days, and the quantity amounts to about one gallon for every two bushels of grain and malt. In three or four days the temperature rises to about 80, and sometimes to 90; great quantities of carbonic acid are disengaged, and the liquid becomes lighter. In about six or eight days the fermenting tubs are closed up, and at the end of ten or twelve days the fermentation is completed. The specific gravity of the liquid is now probably not higher than 1.000, and consists of alcohol mixed with undecomposed saccharine and farinaceous matter. The larger the proportion of alcohol, the greater the quantity of sugar, which is so much waste occasioned by the laws obliging the distiller to make his wash of a certain strength. Wort, or the mere infusion of malt and grain, is a liquid of a brownish colour and of a sweet luscious taste. When chemically examined, it appears to consist of a *saccharine matter*, analogous to sugar, *starch*, *gluten*, and *mucilage*. The principal alteration, therefore, which the wort has undergone by fermentation is, like the alteration in *must* by the same process, the conversion of the saccharine matter into alcohol. Wort, however, unlike *must*, will not ferment without the addition of yeast. It becomes, therefore, a matter of curious investigation to know what yeast imparts to the wort to induce the commencement of this process. It was ascertained by Fabroni, that a substance analogous to gluten was necessary to fermentation;

such a substance can be extracted from must, and it exists ready formed in the grape, though probably it is separated from the saccharine part by being lodged in the membranous part of the grape. After this substance was extracted, gluten was found to promote the fermentation, and Thenard and Seguin have found that all juices which undergo spontaneous fermentation contain a similar substance. It has been also ascertained that yeast contains a large quantity of a substance resembling gluten, and that if this is separated it loses the property of exciting fermentation. This peculiar substance existed in the grain, but underwent modifications during the process of malting and during the fermentation of the beer from which the yeast is separated.

The changes which take place in the juice of fruit, or in the conversion of wort into wash or beer, have been thus explained:—It has been found that sugar dissolved in four times its weight of water, mixed with yeast, and placed in a proper temperature, ferments precisely as wort does, and yields the same products. Chemists, therefore, have made experiments on it, as a more easy manner of determining the phenomena. Thenard mixed 60 parts of yeast and 300 of sugar, and fermented them in a temperature of 59°. In four or five days the saccharine matter had disappeared, and 94.6 parts by weight of carbonic acid were evolved. On distillation the fermented liquor yielded 171.5 parts of alcohol, spec. grav. 0.822; by evaporation 12 parts of a nauseous acid substance were obtained, and 40 parts of the yeast, deprived of its azote, remained, and there was a loss of 41.9 parts. Now as sugar is composed proportionally of 5 oxygen, 6 carbon, and 5 hydrogen, and as alcohol is a compound of 1 oxygen, 2 carbon, 3 hydrogen, it is supposed that the action of the yeast, which has a strong affinity for oxygen, is to take some of it from the saccharine matter, and that when the decomposition is once begun, it afterwards goes on by itself, the sugar losing in the process oxygen and carbon, which unite and escape in the shape of carbonic acid gas. Whether or not this is a correct explanation of the phenomena we will not decide, but it has probability in its favour. Water and a certain temperature, certainly above the freezing point, are absolutely necessary for fermentation, and if the analysis of the substances produced and employed be correct, it would appear that the quantity of alcohol obtained is always proportionate to the quantity of sugar which is decomposed.

As we have no plate to present our readers connected with fermentation, we have thought proper to subjoin a sketch of the spirit receiver ordered by act of parliament to be provided by all distillers. It is to be properly gauged and entered in the books of the excise officer. No. 1 is the still, 2 the worm tub, 3 the receiver, provided with a lock, and a case for inclosing and securing the lock.

The UTILITY of Mr. BROWN's ENGINE DENIED.

In the first Number of The Chemist we recorded some experiments of Sir H. Davy's on the condensation of the gases, and mentioned the probable application of this method to produce a moving power. In No. XVII. we gave M. Bussy's account of a very simple and apparently efficacious means of accomplishing the same object; and in our No. XVIII. we mentioned Mr. Brown's invention of an explosive engine. From the specification of this engine, which we now subjoin, it will be evident to our chemical readers that its moving power is in fact occasioned by the sudden condensation of certain gases, producing a partial vacuum. It was lately said by Dr. Birkbeck, in lecturing on the steam-engine, " that this machine was at present so perfect as to leave nothing to be desired." It is, however, plain that we never

desire that of which we are perfectly ignorant, and the steam-engine will only appear perfect till something better is imagined or thought of. Beautiful and perfect as it is, from the following first attempt, it would seem, though we do not say that it is successful, that other means of producing a vacuum, besides the employment of steam, may possibly be advantageous.

This engine is a hydro-pneumatic one, partaking of the principles of Savery's and Newcomen's steam-engine, and also of some modifications of the same principles subsequently introduced by others; but instead of condensing steam within the cylinders to effect a vacuum, the exhaustion is here to be produced by ignited gas, issuing from jets, which, by consuming the air in the closed vessels, permits the superincumbent atmosphere to force water up tubes into the vacuum chambers, and flowing thence into the periphery of a bucket water-wheel, is thereby intended to give a rotatory power for the purpose of actuating other machinery.

A piston may be worked upon the principle of producing a vacuum beneath it, by burning the air in the way above described; and this may be done in a distinct vessel, so as to communicate with several cylinders, and consequently to work several pistons at the same time, the air and vacuum valves being opened and closed by similar means to those adapted to work the induction and eduction valves of steam-engines.

The claim of the patentee is limited to his mode of effecting a vacuum by burning gas in a vessel, and thereby consuming the air within.

The advantages to be derived from the engine above described, are stated to be—

"First, The quantity of gas consumed being very small, the expense of working the engine is moderate. In its application on land, the saving will be extremely great; the cost of coal gas (deducting the value of the coke) being inconsiderable; and although the expense of working a marine engine will be greater, as the gas used for that purpose must be extracted from oil, or some other body equally portable, yet even then it will not equal the cost of the fuel required to propel a steam-boat; and, as a few butts of oil will be sufficient for a long voyage, vessels of the largest tonnage may be propelled to the most distant parts of the world.

"Secondly, The engine is light and portable in its construction, the average weight being less than *one-fifth* the weight of a steam-engine and boiler of the same power; it also occupies a smaller space considerably, and does not require the erection of so strong a building, or of a lofty chimney. In vessels, the saving of tonnage will be highly advantageous, both in the smaller comparative weight and size of the engine, and in the very reduced space required for fuel.

"Thirdly, This engine is entirely free from danger, *no boiler being used*. Explosion cannot take place; and as the quantity of gas consumed is so small, and the only pressure that of the air, it is impossible that the cylinder can burst, or that the accidents incidental to steam-boats can occur.

"The power of the engine (being derived from atmospheric pressure of from nine to ten pounds on the square inch) may be increased, with the dimensions of the cylinders, to any extent, and always ascertained by the application of a mercurial gauge.

"It is scarcely necessary to allude to the well-known fact, that, after deducting the friction arising from the use of the air and cold water pumps, &c. &c. the general *available* power of the condensing steam-engine is from seven to eight pounds per square inch.

"The cost of the machine will be less than that of the steam-engine, *particularly as constructed for raising water*; it is, therefore, peculiarly adapted for draining fens, &c. or supplying reservoirs. The expense of wear and tear will

also be trifling, and when occasionally out of order, it may be repaired at a very inconsiderable cost, and with but little delay."

Since this matter was set up, which was intended for last week's Number, we have met with the following able remarks in the *Scotsman* newspaper on the subject; and we must say, having since seen a more detailed description of Mr. Brown's engine, we are inclined to believe that they are also quite correct. At any rate, it is necessary to brnig before our readers the objections which are urged to the contrivance, more particularly as it is stated that Mr. Brown has already received numerous orders to make engines for individuals on his plan.

"The space under the piston being filled with common air, Mr. Brown introduces a quantity of inflammable gas, from time to time, by a pipe; and at each injection of gas (as we understand) ignites the mixture by bringing a jet of flame (kept at the outside of the cylinder) in contact with it. By this process the whole *oxygen* of the common air is burnt out, and the quantity of the elastic fluid in the cylinder is exactly so much diminished; at the same time, the heat produced by the ignition of the gas makes the remaining air expand, and a part of it escapes by valves. Let the cylinder and the air within it now be cooled down with water applied externally, and the original quantity of air will be diminished, perhaps one-third; the piston of course descends by the pressure of the atmosphere on its upper surface, till the density of the air below equals that of the air above; that is, it will descend, not to the bottom of the cylinder, but through one-third of the space.

"Suppose that he uses pure hydrogen instead of coal gas; supposing, also, that the cylinder below the piston contains five cubic feet of atmospheric air, it will then contain fully one foot of oxygen and four of azote. Now, by letting in two cubic feet of hydrogen, and burning it gradually as it is admitted, the three feet of oxygen and hydrogen will be converted into a few drops of water, and only the four cubic feet of azote will remain in the cylinder. Had the cylinder been entirely filled with oxygen, the whole could have been made to disappear by this process; a real vacuum (practically speaking) would have been obtained, and the piston would have descended to the bottom of the cylinder. As atmospheric air, however, contains little more than one-fifth of its bulk of this gas, four-fifths of the elastic fluid still remain in the cylinder; but the heat produced by the combustion of the hydrogen increases the elasticity of the four feet of azote till it exceeds that of the atmosphere, and a part of it passes off by valves. It would be troublesome to calculate how much this remaining gas will be heated by the combustion of the hydrogen. Let us suppose that its temperature is raised from 50 to that of boiling water, though it is probably not so much; then, we know, that its elasticity would be increased one-third (from 1040 to 1376): the four cubic feet would expand to the bulk of 5 1-3d; of course one-third of a foot would be expelled; and if the cylinder and its contents were now cooled down to the original temperature, the five feet of air would be reduced by the destruction of the oxygen, and the expulsion of a small portion of the azote, to three and three-quarters cubic feet. The piston would now descend till this *rarefied air* (for it is absurd to speak of a *vacuum*) is as dense as the superincumbent atmosphere; that is, it would descend through something less than one-third of the depth of the cylinder. Such is the whole amount of the moving power, which, we verily believe, would scarcely overcome the friction of the machine during its short descent.

"If Mr. Brown employs coal gas instead of hydrogen, and this seems to be his intention, the power, we imagine, will be still less. Assuming, as before, that the cylinder contains five cubic feet of

common air, then to destroy the one foot of oxygen included in this, he must introduee half a foot of coal gas, and the combustion yields about one foot of carbonic acid; so that there is not only no vacuum formed, but there is not even any diminution of volume effected as in the other case. The only result of the process has been to convert the oxygen of the air into carbonic acid. The gas, however, has a greater heating power than the hydrogen; and when it is employed, a little more of the gaseous fluid in the cylinder may be expelled by its elasticity. Mr. Brown's invention, then, will turn out to be simply an engine operating by rarefied air, a thing tried long ago, and found, we believe, to be useless.

We have no hesitation then in avowing our belief, that Mr. Brown's invention, so far as we can comprehend it, is entirely a deception, and one, we think, which could not impose upon any person who has the most moderate knowledge of chemistry and mechanics. Such imaginary improvements are extremely common, and much money is every year thrown away in procuring patents to cover inventions which are absolutely worthless. But Mr. Brown's engine has not even the merit of being new, as we find from the following letter in the *Leeds Mercury*:—

" 'Having seen in your widely circulated paper of last week, an account of an explosive engine, wrought by a new power, viz. the explosion of a mixture of atmospherical air and hydrogen gas, for which, we understand, the inventors have obtained a patent; we beg leave to observe, that we believe the patentees are not the first persons who employed this new power for the propelling of engines. Having witnessed from an accident the effects of this gaseous mixture, the idea of its power was suggested to us, and we applied ourselves to construct an engine to be propelled by this powerful agency, and in the year 1819 completed one, but it being on too small a scale, our expectations were disappointed. About two years ago we completed a larger engine on the same principle, which we had in actual operation; but finding there was no saving from it, owing to the consumption of gas being so great, we abandoned the idea of it ever superseding the power of steam. To work a thirty horse engine on the explosive principle would take more gas than the whole of the Huddersfield Gas-works are able to supply. The nitrogen gas, one of the constituents of the atmospheric air employed, being incombustible, remains in the cylinder after the explosion, and thus renders the vacuum incomplete. We have part of our first and second engine in existence.

" 'Yours,

" 'J. and G. HANSON.

" '*Huddersfield*.' "

DICTIONARY OF CHEMISTRY.

CALORIC SPECIFIC, *specific heat, capacity of bodies for heat, latent heat.* It is known that if we take a series of substances, such as water, oil, mercury, &c., and raise them all to the same temperature, then each of these substances, in cooling down any number of degrees, will communicate to surrounding bodies a different quantity of heat. If, for example, we suppose them to be all at 100°, and then immersed in separate masses of ice, each of them will melt a different quantity of ice in cooling down to its temperature. Again, the quantity of heat, if we may so speak, required to raise each of these bodies to the temperature of 100° will be different; but the relation between them, under the same circumstances, is constant, and the heat which each gives out in cooling, or takes in heating, is always the same under the same circumstances for the same body. The quantity of heat which water takes to raise it any number of degrees is assumed as unity, and then the specific heat of any other body means the relation it bears to water as to the quantity of heat it gives out in

cooling, or requires to heat it. It has been ascertained that almost every body with which the experiment has been made differs from every other in this respect, and therefore all bodies have a specific caloric which may be expressed with relation to water. The other terms have all been applied to this difference of capacity in bodies for heat, but *specific caloric* is now the phrase most generally adopted.

Calorimeter. An instrument for measuring the heat given out by a body in cooling; both ice and water are employed, and the latter is now preferred, but originally the first alone was used.

Cameleon Mineral. A curious substance, so named from the changes which take place in its colour, and formed by fusing an alkali with black oxide of manganese.

Campeachy Wood, *logwood.* A well-known dye.

Camphor. A white concrete substance, resembling spermaceti in appearance, but having a strong, lively, acrid taste. It is obtained from the roots, wood, and leaves of two species of laurel which grow in the eastern part of the world. It is used chiefly in medicine.

Camphorates. Salts composed of camphoric acid and a base, of which nothing is known.

Camphoric Acid. A peculiar acid obtained from camphor.

Cannon Metal. An alloy of 100 parts copper and 10 or 12 of tin.

Cantharidin. A name given to the peculiar substance extracted from cantharides, or Spanish flies, which excites blisters when applied to the skin.

Caoutchouc, *India rubber. Elastic gum.* Is the dried juice of some plants, such as the *jatropa elastica*, which grow in hot climates. It is a very useful substance, and from the late improvements in the management of it, promises to be of still greater service in the arts.

———— Mineral. A substance resembling India rubber, found in Derbyshire.

Carbon, *pure charcoal.* An elementary substance.

POTATOES A SUBSTITUTE FOR SOAP.

It is stated in the *Bulletin Technologique*, that potatoes, three-fourths boiled, employed instead of soap, are more efficacious than it in cleansing clothes of all descriptions. They are used as soap, and the clothes are otherwise washed in the same manner, though without employing any alkali. This will, however, be of little use in England, where washing by *steam* is growing fashionable. By the bye, we wonder the washerwomen of the kingdom have not united to petition Parliament against the new Steam-washing Company. Were this laudable body properly represented in parliament, the trade of the wash-tub could not be thus injured with impunity. We are afraid our publication is not much studied by them; but if the Economist were under our direction, we should certainly rouse these much-injured women to take care of their own interest.

TO CORRESPONDENTS.

We are glad to see the hand-writing again of our friend The Chemist, *and congratulate him on his return.*

Mr. Thompson *is informed, that we know of no book like the one he mentions; and that, in no treatise on distillation, with which we are acquainted, is any thing said of the subject on which he requires information. He will find some observations in all chemical treatises, but there is no separate work on this particular branch. He should, however, rather apply to his own bookseller than to us.*

*** *Communications (post paid) to be addressed to the Editor, at the Publishers'.*

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The Chemist.

"—— Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if nought in these external scenes
Can move thy wonder?——"

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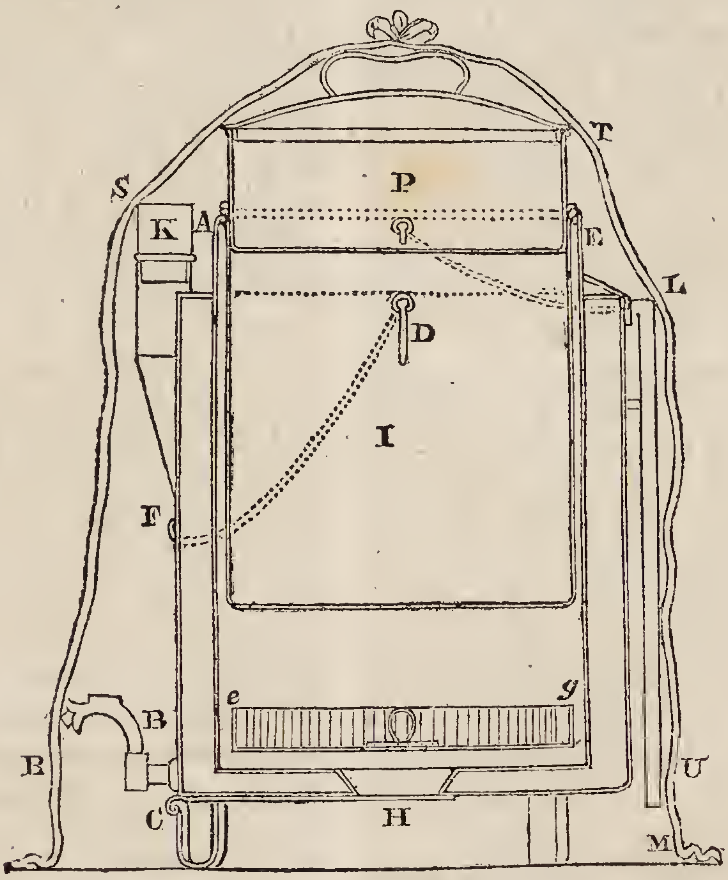

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CHEAP SOUP-MAKING POT.

If the English were only half such a soup-loving people as the French, we should think the following invention of M. Lemaire's of admirable utility. As we, however, from having good beef, prefer eating that to drinking soup, it can be to us only of trifling advantage; still, as there may be economy in its use, we shall give a short description of what he calls a *caléfacteur*. Our plate represents a vertical section of this apparatus:—

A B C D is an external cylindrical vessel soldered to an internal one of the same shape, which it completely surrounds; and this species of double vessel is open at the top, while the double plate, which forms the bottom, has a hole at H, establishing a communication between the inner cylinder and the open air. By means of H C, a register, this hole can be opened and shut at pleasure. The space between the two cylinders has only three openings, one at K for pouring in water; another at L for allowing the escape of the steam, by means of the tube L M, which may, however, be dispensed with, as K will also serve for the purpose; and a third with a cock at B to draw off the water. Another cylindrical vessel, I, concentric to A, but somewhat smaller in diameter, enters it. Its upper part has a rim, and three little projections corresponding to three openings in the upper part of A, so that when these do not correspond, I does not sink quite down, and when they correspond it does, and completely closes A: it reaches only part of the way to the bottom of A. Below it there is placed, about six lines from the bottom, and nearly as large as the large vessel, a hearth or dish of cast iron, pierced with holes, and having its edge turned up all round. A third cylindrical vessel, P, having a lid, enters into the second, and shuts tight upon it. A F D is a handle by which the whole may be moved, and R S T U is a wadded cloth, which serves to wrap up the whole and keep in the heat when required. On filling the space between the two concentric parts of the vessel A B C D, the vessels I and P with water, and putting a fire on the hearth, (the capacity of water for heat being very great) we obtain a large magazine of heat, which may be preserved for a considerable time by making use of the wadded cloth. To prepare soup, put the meat and water in the interior vessel, the partition between the exterior one being also filled with water; make a fire with a small quantity of charcoal on the hearth, *e g*, and then put in the interior vessel, I, which must not be allowed in the first instance to go quite down to its resting place, in order that the carbonic acid gas may escape. When the water in the inner vessel begins to boil, it is to be skimmed, and vegetables and salt added, with the other necessary ingredients to make soup. The vessel I is then again covered, and allowed to fall quite down, so as to close up the outer vessel, in which it exactly fits. The upper vessel, P, will, by this time, be found to have lost a portion of water by ebullition, and this must be replaced. The register, H C, is pushed home, all access of air is cut off, the fire goes out, and the whole is to be covered with the cloth. At the end of six hours the soup or beef tea will be found ready, and the surrounding water will still remain hot. The advantages of this method are, that it extracts all the goodness of the meat without wasting any by too fierce an ebullition; it costs but little, and requires scarcely any care in the cooking. We can readily conceive, that our soup and mirth-loving neighbours must prize such an instrument highly. They may sing or dance, or play billiards or cards, while this *pot au feu* makes ready their dinner without any concern on their part. We need not, therefore, be surprised, that some members of the French Institute should have been commissioned by that learned body to make a report on this valuable instrument. For our parts, having long observed the proceedings of that illustrious body, we congratulate them and the world on this useful employment of their time. M. Thenard, who has had his soup made by this instrument for upwards of three weeks, declares he will taste no soup not made by M. Lemaire's *caléfacteur;* and Mr. Thomas Gill, the very illustrious editor of the Technical Repository, smitten with the approbation of this celebrated chemist, and the approval of the

very learned society just mentioned, has hastened to transplant the *caléfacteur* into the pages of that work. Although he has a great objection to the exportation of British machinery, he has, apparently, a love for the importation of French soup-kettles. In fact, he has, on this point, outstripped us. We had long ago selected, from the *Dictionnaire Technologique*, the present description and plate, as a little article of useful information; though we should never have thought, in imitation of our pomp-loving neighbours, of calling a soup-kettle by such a fine name as a *caléfacteur*.

INFLAMMATION OF SULPHURETTED HYDROGEN GAS BY NITRIC ACID.

When a few drops of fuming nitric acid are put into a flask filled with sulphuretted hydrogen gas, the hydrogen is oxidized by the nitric acid and the sulphur is disengaged in a solid form. If the flask be closed with the finger, so that the gas which becomes heated cannot escape, its temperature is raised so much as to produce combustion, with a beautiful flame, and a slight detonation which forces the finger from the mouth of the flask.

This experiment may be made without the least danger, with a flask containing four or five cubical inches of gas.—*Berzelius.*

ANALYSIS OF SCIENTIFIC JOURNALS.

ANNALS OF PHILOSOPHY FOR SEPTEMBER.

Those who have paid any attention to the matter, have long ago seen and acknowledged that the great mass of literary and scientific men form a separate class in society—that their pursuits are never judged of but by themselves—and that they possess the singular advantage of determining public opinion as to the value of their researches and discoveries. Being the pen-holders, or secretaries, of society, they make it affirm what they please. They are themselves their own judges. Hence it is that we never meet with a doubt expressed in writing of the superior and almost sublime nature of every sort and species of book learning. Whatever is taken up as an amusement, as a relief from weariness, by those who are both opulent and well educated, is raised to the dignity of a noble task. During the period when monasteries existed throughout Europe, in all the pride of enormous wealth and in all the wretchedness of idleness, their inmates, having neither wives nor children to provide for, neither relations nor friends to interest their hearts,—being shut out from almost all participation in the business of the world, sought relief from this state of melancholy woe in a variety of literary pursuits; and much of what they had thus recourse to as a means of getting rid of their heavy hours, they being at the same time almost the only authors, and some of them the instructors of youth, came to be considered, and is still considered, as science and knowledge. To place accurately the emphasis in a line of ancient poetry, to ascertain precisely the number of its syllables, to supply the vacancies in dilapidated manuscripts, being probably the theory of Greek stops or the history of some obscure Latin author, were some of the occupations of the monks, and still continue to be taught as the highest of all human attainments in those worthy representatives and descendants of the ancient Benedictine monasteries, the universities of Oxford and Cambridge. In our own time we see the pursuits of the opulent and idle raised by the praise of literary men to the dignity of art, and placed on an equality with the most useful branches of industry. A nobleman who collects and admires fine pictures, or builds a magnificent mansion, is a man of taste and learning; and if he collects old books or black letter prints, and arranges them in a showy library, publishing a fine catalogue of them, he is probably described as a man of

eminent attainments, and as a benefactor to the species. In the same manner, if a wealthy rector, disdaining the occupation for which he is paid, turns over the cure of souls to his serving man, for a fourth part of his own revenue, (pocketing, like an army contractor for bread, all the difference between what he receives for performing a service and what he must pay another for doing it,) and amuses himself with prying into Saxon antiquities, or in endeavouring to find out how the world was created, he is described not merely as employing his leisure in an inoffensive mode, but as benefiting mankind by his exertions. We have no kind of antipathy to such persons, but we wish them to preserve their proper place in general estimation. They have quite enough of worldly admiration, and quite enough of worldly enjoyment from their rank and their wealth, without the humbler classes of society, to whose industry and whose exertions they are indebted for their daily bread, being also called on to reverence their amusements as wisdom, or as intended to improve the condition of man. We do not wonder that such persons and such pursuits should be lauded by those who look up only to this favoured class of society for wealth, but we are surprised that a scientific journal should devote its pages to the biography of one such character. The Reverend J. J. Conybeare was, it is true, an occasional contributor to the Annals of Philosophy, and his valuable accounts of "The Greek Fire," and on "Newer Red Sand-stone," being, as his biographer says, not the result of labour, but a mind demanding occupation, have secured for him a niche in the immortal temple of science, to be formed by the volumes of this work. The Rev. J. J. Conybeare was, according to his biographer, a very good sort of man; but as far as his labours are known to us, we cannot see in what way he has benefited mankind, or deserves, more than any other whist-playing or book-writing clergyman, to have that honour conferred on him, which is all we can bestow on the memory of a Watt or a Davy. We must protest, for our parts, against an indiscriminate heaping of eulogies on insignificant persons; it tends to confound all correct notions. Approbation is the only and the highest reward men can bestow on the most useful virtues; and we ought, therefore, to be cautious how we place on the same level those who write trifling papers for their own amusement, and those who add to the knowledge and power of their species. We will believe the biographer of Dr. Conybeare, that his talents were of the first-rate description; and when this praise is balanced against his leisure and what he peformed, nothing remains worthy of being admired and recorded. We cannot, therefore, give any further account of the first article in the Annals for September, than to say it is the biography of the Reverend J. J. Conybeare, M. A., M. G. S., &c. &c.

In truth, the only article which seems worthy of any notice, as far as utility is concerned, is the 3d, which is by Dr. Bostock, and relates to the "Applicability of Sir H. Davy's discovery to copper vessels employed for culinary purposes." It is Dr. Bostock's opinion, "that though copper is preserved by tin from the action of acetic acid in the same manner as it is from that of sea water, yet we cannot make use of this principle in vessels intended for culinary purposes, in consequence of the volatile nature of the acid."

The remaining articles, "Herschel on certain Motions produced in Fluid Conductors, when transmitting the Electric Current;" "Powell on Terrestrial Light and Heat;" "Berzelius on the Combinations of Acetic Acid with Peroxide of Copper;" "Gay Lussac on the Chloride of Lime"—are all too long and too forbiddingly abstruse and technical for our pages. The Reverend Mr. Emmet, "On the Combination of Potassium and

Oxygen," though a great admirer of the atomic theory and the principle of all bodies consisting of atoms, states a deduction from this theory which might alarm the most confiding faith. We must give this

ATOMIC ABSURDITY.

"The volume of an atom of potassium $= \frac{37.5}{0.85} = 44.11$, and the volume of an atom of dry potash $= \frac{45.}{2.5} = 18$. The *volume* occupied by the atom of oxygen in this compound = volume of potash — volume of potassium $= 18 - 44.11 = -26.11$; so that, 37.5 parts of potassium occupy a volume which may be represented by 44.11; by combustion, it combines with 7.5 parts by weight of oxygen, and the volume becomes 18; consequently the space occupied by the oxygen is negative, i. e. 26.11 of space less than 0, which is absurd." He endeavours in vain to explain this absurdity of the atomic theory; and finally concludes, "there is no parallel." We have no doubt, however, that as the theory is pushed through all its consequences, many parallels to this in absurdity will be discovered.

In a paper on Mr. Daniell's work on Hygrometry, we find the following observations, which may be useful to some of our readers, as stimulating them to turn their attention to making barometers; and to others, as warning them not to place too much faith on these, at present, ill-made instruments:—

"Mr. Daniell's account of the manufacture of barometers and thermometers is most certainly not overcharged. Throughout the Continent, and even in England, the business is in the hands of itinerant Piedmontese; and these artists supply not only the general public with their glittering baubles, but furnish the greater part of the most reputable instrument-makers with their whole stock of meteorological wares. Such of these as choose to graduate their own scales, must confide entirely as to the quality of their tubes and the excellence of the filling, in one who has but indirect interest in the matter, or equivocal reputation to lose; responsibility is thus shuffled from both, and rests on neither. Such, however, are the people who by unaccountable prescription supply the city of London, and the philosophers of England, with the instruments which Mr. Daniell so well describes.

"If common notoriety did not bear Mr. Daniell out in his assertions, the shameful disagreement of the thermometers used by Captain Parry in his last voyage would fully do so. On one occasion this amounted to no less than 13 degrees; Capt. Parry could do nothing else than give a mean, though in such a case — 48° had as good a *chance* of being the truth as — 35°."

UNEQUAL DISTRIBUTION OF HEAT IN THE PRISMATIC SPECTRUM.

That the different portions of the prismatic solar spectrum possess different heating powers, has been universally admitted by every philosopher who has examined the subject experimentally; but a great diversity of opinion has prevailed respecting the precise point where this power resides in its greatest intensity. Landriani, one of the first who investigated this subject, placed the maximum heating power in the yellow rays, Rochon in the orange or orange yellow, and Senebier also in the yellow. Herschel, on the contrary, found the heating power of the red to be superior to that of all the other coloured rays; but that there is a certain point of the spectrum, situated immediately beyond the red and invisible, which elevates the thermometer still higher than any of the visible rays. His experiments were directly contradicted by Leslie, but were soon after, in a great measure, confirmed by Englefield. Dr. Seebeck, in a memoir read to the Royal Academy of Sciences in Berlin, which, with numerous original experiments, com-

bines a copious discussion of the opinions of preceding inquirers, appears to have ascertained the cause of those anomalous statements. It exists in the particular nature of the medium by which the rays of light are decomposed; a circumstance so little regarded, that few experimenters have even deemed it necessary to record the material of their prism. The following is a summary of his results.

In every part of the prismatic spectrum there is a perceptible elevation of temperature, and this is uniformly least in the outermost edge of the violet. From the violet it gradually increases, as we proceed through the blue and green into the yellow and red. In some prisms it attains a maximum in the yellow, as, for example, in those filled with water, alcohol, or oil of turpentine. In others, as in those filled with a transparent solution of sal ammoniac and corrosive sublimate, it attains a maximum in the orange. Prisms of crown glass and of common white glass have the maximum of temperature in the centre of the red; others, which appeared to contain lead, have the maximum in the limit of the red. Prisms of flint glass have the maximum beyond the red. In all prisms, without exception, the temperature regularly diminishes from beyond the red; but it still continues perceptible at a distance of several inches from the extremest limit of that side of the visible spectrum.—*Schweigger's Neues Journal*, vol. x. p. 129.

CONVERSION OF HONEY INTO SUGAR.

The Jews in Moldavia and Ukrane have a method of making honey into a hard and white sugar, which is employed by the distillers of Dantzic to make their *liqueurs*. The process consists in exposing the honey to the frost during three weeks, sheltered from the sun and snow in a vase of some material which is a bad conductor of caloric. The honey does not freeze, but becomes transparent and hard as sugar.—*Hanoverisches Magazin.*

ATTRACTION OF PARTICLES OF GASES.

Woolwich, Sept. 3.

The study of any science, particularly that of chemistry, is pursued with more facility and pleasure, the more clearly the facts connected with it are stated and the phenomena it presents are more accurately viewed. To accomplish this being one principal design of your publication, encourages me to offer the following observations.

All the chemical authors which I have read, when treating of the three forms of matter (solid, liquid, and aeriform,) assert that the gaseous is that state in which the attractive force is *entirely* overcome, and the repulsive has gained the ascendency, or that the particles of gases are mutually repellent.

Now, Sir, in first reading these assertions, I was very much perplexed, for I cannot conceive how substances can exist while their particles repel each other; indeed, were this the case, I should imagine that the moment substances assumed this form, they would fly off in all directions, and constitute an indiscriminate and heterogeneous mixture with the atmosphere and each other; consequently we should not be able to obtain any such thing as a simple gas.

But from a more minute consideration, I think a very cursory view of the subject will prove that every species of attraction exists in the gaseous as well as any other state, *e. g.* take two volumes of carbonic acid gas, pour them into an open vessel, it will displace the atmospheric air, combine, and form one volume equal in bulk to both; it may also be allowed to remain in the vessel for a considerable time without mixing with the atmosphere: its particles, therefore, possess sufficient attraction to each other to cause them to unite, and preserve their identity after they have united; and this experiment may be performed with any other gases, where the difference of specific gravity is sufficient, and no particular chemical affinity exists;

and this I consider the attraction of aggregation, in the strictest sense of the word.

It were unnecessary to attempt to prove that the attraction of gravitation or combination exists in the particles of gases, as *that* is evident from their weight, and *this* sufficiently obvious from the numerous instances of gaseous combination, which all your readers must be acquainted with.

If you consider these remarks deserving a place in your useful work, they are at your service; and by inserting them you will oblige

Your humble servant
and constant reader,
J. ALWIN.

TO FREEZE ONE LIQUID AND BOIL ANOTHER BY THE SAME MEANS.

THE old story says, that the satyr turned the hungry and half-frozen traveller out of his cave for blowing hot and cold with the same breath. The manner in which heat is distributed has taught us that in this instance, at least, *man* was right and the satyr wrong. But if this surprised him, what would he think of the wonders of modern chemistry,—of seeing, for example, one fluid frozen and another made to boil by the same means? If we take, for instance, a small tin cup of ether, put it within a watch-glass containing water, and place both under the receiver of an air-pump, it will be found, on exhausting the receiver, that the water will freeze and the ether boil. The reason is, as the air is expanded, the ether, by its own caloric, and absorbing caloric from the water, is converted into a gas, which escapes in ebullition, while the loss of caloric suffered by the water converts it into ice.

QUERIES.

To the Editor of the Chemist.

SIR,—You would greatly oblige a constant reader by inserting the following query:—I wish to ascertain if a more expeditious method (but at the same time equally eligible) cannot be made use of than the one at present employed in tanning.

I am, Sir,
Your obedient servant,
Manchester. INQUISITUS.

Is there any liquid or preparation known, with which a room, ornamented with size-colouring, may be washed, so as not to shine like varnish, and which will bear cleaning with water?

ELECTRICITY BY WATER FREEZING.

WHEN water is frozen rapidly in a Leyden jar, the outside coating not being insulated, the jar receives a feeble electrical charge, the inside being positive and the outside negative. If this ice be rapidly thawed, an inverse result is obtained; the inside becomes negative and the outside positive.—*Quarterly Journal of Science.*

TO DETERMINE SPECIFIC GRAVITIES.

IF the body be a solid, fill a phial with water, and note its exact weight in grains. Take a hundred grains of the substance to be examined and drop it into the water; now weigh the phial again, and the difference between its present and former weight will give the specific gravity of the substance. If the body be a liquid, a bottle or phial, the weight of which is known, and which holds exactly five hundred or a thousand grains of water, is to be filled with the substance and weighed: the weight, deducting the weight of the bottle, will be the specific gravity of the substance. For example, if the bottle contain a thousand grains of water, and be filled with sulphuric acid, it will be found to weigh from 16 hundred to upwards of 18 hundred grains, and the weight will be the specific gravity.*

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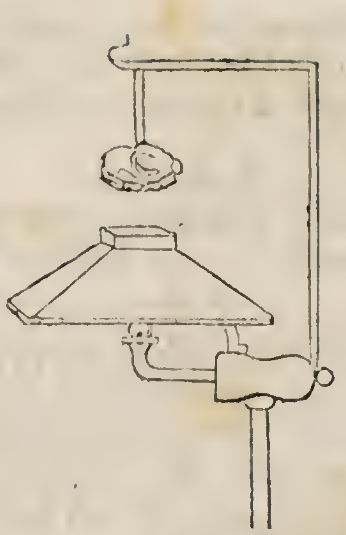
* For an explanation of specific gravity, see Chemist, No. XXIV., Article, Chemistry.



FRAGRANT LAMPS.

Mr. Editor,—Perhaps you may thank me for the following little account of a method of preserving the air of apartments comparatively pure, and at the same time of dispersing a pleasant fragrance through them. By means of a wire fixed to one side or at the back part of the lamp, according to its nature, and bent at right angles, so as to be a few inches above the top of the flame, a piece of sponge is to be suspended. This is to be soaked in a mixture of best vinegar and water, and squeezed nearly dry before it is hung up. By this means the vinegar is constantly dispersed through the apartment, and gives a very fragrant smell. It would probably be very useful in manufactories and close workshops, and is of course as easily applicable to gas as other lights. It costs very little, for the same piece of sponge has served me a whole winter. It must be occasionally re-immersed in the water and vinegar, and then will be found to give out a great quantity of soot, which otherwise fouls the air of the apartments.

Your obedient servant,
Ein Deutscher.

DISTINCTION OF POSITIVE AND NEGATIVE ELECTRICITY.

Positive and negative electricity may be readily distinguished by the taste, on making the electric current pass by means of a point on to the tongue. The taste of the positive electricity is acid; that of the negative electricity is more caustic, and, as it were, alkaline.—*Berzelius.—Journal of Science.*

PRESERVATION OF SEEDS.

The late M. Zea, the celebrated Peruvian botanist, asserts, that the most delicate seeds of American plants may be sent to Europe in the highest preservation, by being enveloped in that kind of raw brown sugar which always keeps its humidity. When the seeds are to be sown, it is only requisite to immerse them in lukewarm water, which will take off the sugar.

NATURAL CARBONATE OF SODA.

M. Rivero, of Santa Fé de Bogota, informs us, that he finds the following to be the constituent parts of the natural carbonate of soda of the lake of Merida, in Colombia:—

Carbonic acid	0.3900
Soda	0.4122
Water	0.1880
Loss	0.0098

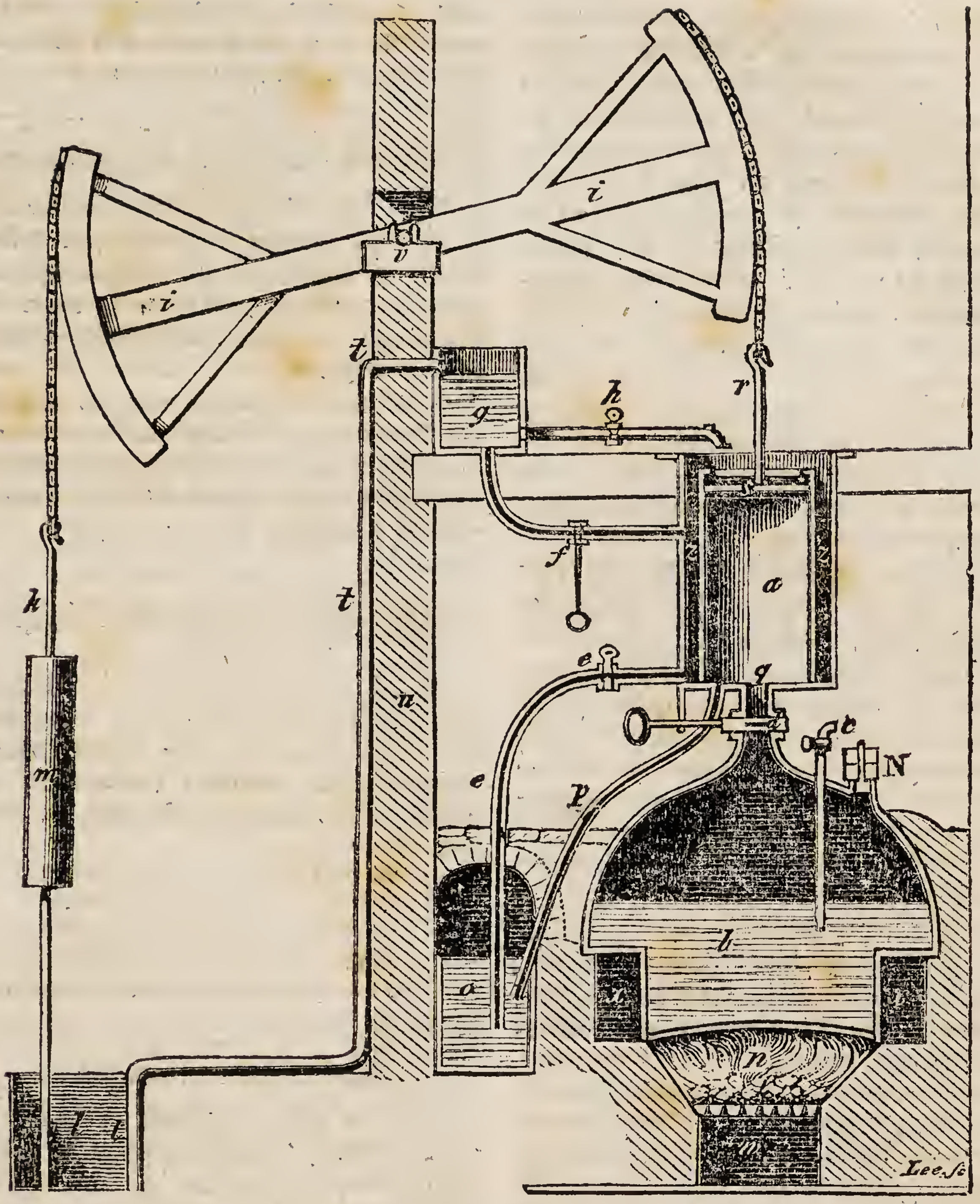
Jameson's Philosophical Journal.

COLOURED FLAMES.

Add a little boracic acid to a spoonful of alcohol, and stir them together in a saucer or cup, then set them on fire, and the flame will be of a beautiful green colour. If strontites in powder be added to alcohol, it burns with a carmine flame; if barytes be added, the flame is yellow; if the alcohol contain muriate of magnesia, it burns with a reddish-yellow flame.

TO MAKE AND DESTROY COLOURS.

Drop as much sulphate of copper into water as forms a colourless solution, add a little ammonia, which is equally colourless, and the mixture becomes of an intense blue colour. Add again a little sulphuric acid and the colour disappears, which is again restored by a little solution of caustic ammonia.



DESCRIPTIVE HISTORY OF THE STEAM-ENGINE.

(*Concluded.*)

After Savery's engine became known, a great deal more attention was directed to the subject than before; and the names even of those who were successful in their attempts to improve it, would occupy no inconsiderable space. In Savery's engine, " the effect is produced by the condensation of the steam forming a vacuum in a receiver, into which the water is forced by the pressure of the atmosphere; and where the water was required to be elevated to a greater height than from 28 to 30 feet, he employed the *direct* pressure of steam of a *high pressure and dangerous elasticity*." It could only, however, be applied with safety to raise water about 30 feet. A very short time after the publication of Savery's book, Thomas Newcomen, a blacksmith, and John Cawley, a glazier, both living in the town of Dartmouth, in Devonshire, " made the experiment of introducing steam under a piston moving in a cylinder, and formed a vacuum by condensing the steam by an effusion of cold water on the outside of the steam vessel, and the weight of the atmosphere pressed the piston to the bottom of the cylinder. This was the first form of the atmospheric engine, the simplest and most powerful machine that had hitherto been constructed. In the atmospheric engine the process is totally different from that in

Savery's engine; the steam exerts no direct action upon the water, or on any part of the apparatus, it is merely employed as a means of forming a speedy vacuum under a piston attached to one end of a lever, the rod of a pump piston or plunger being affixed to the other extremity." Of this first atmospheric engine we shall subjoin, with Mr. Stuart's permission, his description:—

"In this construction the power of the engine has no reference whatever to the *strength* or *temperature* of the steam, but depends upon the superficial dimension of the piston beneath which the vapour is introduced from the boiler. The steam cylinder, T, was now, for the first time, effectually detached from the water-pump.

"The steam generated in a boiler, *b*, was admitttted through the cock, *d*, and pipe, *q*, into a cylinder, *a*, under the steam piston, *s*, attached by the rod, *r*, to the lever or beam, *i i*, moving on the axis or fulcrum, *o*. The cylinder, *a*, was placed in another cylinder, forming a concentric space, *z z*, round it. This outer cylinder was connected by a pipe, *f*, to a reservoir, *g*, containing cold water. Another pipe proceeding from its lower end was inserted into the well or second reservoir of cold water.

"The piston being in the position shown in the Figure, and the cylinder, *a*, being filled with steam through the pipe, *q*, the cock, *d*, is turned, which shuts off the communication between the cylinder, *a*, and boiler, *b*. By opening cock *f*, cold water is now allowed to flow from the reservoir, *g*, through the pipe, *f*, into the outer cylinder, *z z*; this cools the cylinder, *a*, containing the steam, which condenses the included vapour, and forms a *vacuum* under the piston, *s*. The pressure of the atmosphere meeting with no resistance from the elasticity of the steam, forces the piston to the bottom of the cylinder.

"By this movement, the end of the lever, *i*, attached by the rod, *r*, to the piston, is depressed; and the other end of the lever to which the pump-rod is fixed, is raised, and draws up all the water above the plunger in the pump barrel along with it.

"Now, if we suppose the cold water which has been in contact with the steam cylinder to have condensed all the vapour, the atmosphere will press on the piston with a force equal to that which would be produced by placing about 14¾lbs. weight on each inch of its surface. If the piston were 62 inches square, this would be about 915 pounds weight, operating to force it downwards; and, if there were no resistance from friction, it follows, that in the same time an equal weight placed at the other end of the lever beam, or a column of water, weighing 915 pounds, would be lifted as high as the steam piston had been depressed in the cylinder.

"When the piston has arrived at the bottom of the cylinder, the cock, *d*, is turned, which again opens a communication between the boiler, *b*, and the steam cylinder, *a*. In this engine, the steam being only equal to the pressure of the atmosphere, the piston, *s*, must be raised by other means to the top of its cylinder. This is effected by a counterpoise, *m*, fixed on *k*; which is so adjusted as to depress the pump rods, and thus to raise the steam piston into the required position. During this operation the cock, *f*, is shut, and the cock, *e*, is opened, and the water heated by the condensation of the steam in the condensing cylinder, *z*, escapes into the well or tank, *o*. A very small quantity of water being formed in the steam cylinder, *a*, by the condensation of the vapour, is allowed to fall through the pipe, *p*, into the same receptacle. The cylinder being a second time filled with steam, the cock, *f*, is opened, and cold water flows from the reservoir, *g*, into *z*; the steam under the piston is again condensed. The pressure of the atmosphere a second time having the preponderance, the piston is depressed, and the pump rod at the opposite end of the lever beam is elevated, lifting up the column of water in the pump barrel as before. By closing cock *f*, opening *e* and *d*, the counterpoise, *m*, again acts to raise the piston, *s*, and the operation may thus be indefinitely repeated.

"The fire-place under the boiler is shown at *n*, the ash-pit at *w*; *x x* are the smoke flues; N is a safety-valve; *c* a *gauge pipe*, as in Savery's engine; *u* a wall or post supporting the axis, *v*, of the lever beam, *i i*; *t t* a pipe connected with the pump barrel, in which the cold water rises to supply the reservoir, *g*; *v l* is the mouth of the well or mine which is to be drained; *h* a pipe proceeding from *g*, through which water flows on the top of the piston to keep it air-tight, a contrivance first used by Newcomen."

For the modern improvements in this valuable machine, we must refer our readers to Mr. Stuart's book, where they will find them amply and, we think, justly and impartially given. In reading them, it has occurred to us, that no subject is better calculated to teach a man of inventive genius a becoming humility, and to relieve less gifted persons from the awe they might be disposed to feel in his presence, than the contemplation of the gradual and successive steps, as they are here brought before us, by which science is enlarged or art improved. The utmost benefit which any individual has yet conferred on the human race only amounts to some slight extension of a principle, or some small improvement in art. We say slight and small in comparison with the mass of our knowledge, and with the widely extended field of human discoveries. It will be found, on examining the history of any remarkable invention or improvement, such as printing, the experimental mode of philosophising recommended by Lord Bacon, the invention of fluxions, Mr. Watt's improvement in the steam-engine, and Sir Humphrey Davy's successful researches with galvanism, that they belong much more to the AGE than the individuals, who were, so to speak, but the foci, which collected and converged to one point the light and knowledge radiating from all around them. Successful efforts are in general eagerly seized on and recorded, while a thousand unsuccessful experiments, tending to the same object, and each of which seemed on the point of attaining it, though serving as guides to the successful inquirer, are suffered to sink into oblivion. Thus, after a short period, the successful man, the scaffolding by which his glory was built up being pulled down and put for ever out of sight, stands far above all surrounding objects, challenging, either in person or by reputation, the worship even of the men whose labours assisted in raising him to eminence. The origin of the art of printing is lost in obscurity, but enough of it is known to satisfy us, that many minds, existing at periods remote from each other, concurred in perfecting the invention. Hooke and others had practised what Bacon taught, before he recommended it by his eloquent words. So prepared was the way for the invention of fluxions, that to this moment it is somewhat doubtful whether the priority belongs to Newton or Leibnitz. Jonathan Hull, 60 years prior to Mr. Watt, suggested that the "alternate rectilineal motion of a piston rod might be converted into a continuous rotatory one by the means of a crank;" and "this is now considered to be that invention which introduced the steam-engine as a first mover of every variety of machinery." We learn, also, from the present work, that Professor Robison "threw out to Mr. Watt the idea of applying the power of the steam-engine to the moving of wheel carriages, and to other purposes, but the scheme was not matured, and was soon abandoned on his going abroad." It is, further, quite evident, that but for the great number of chemical discoveries which were made about the period of Mr. Watt's great inventions, particularly relative to heat, and but for the skill which workmen at that period had begun to acquire in manufacturing iron, that his admirable and beautiful inventions could never have been thought of, and never carried into execution. After making, on these accounts, a rational deduction from the merit of Mr. Watt, enough still remains to challenge our admiration of him as the great improver of steam-engines; and were it more, we should rather regard him with awe, as some superior being, than as a man like ourselves, whose virtues we might imitate, and whose inventions we, living at a later period, may possibly surpass. In the same manner, if we look at the discoveries which are every day made in chemistry, and at the experiments which fail, there will

still remain enough in Sir Humphrey Davy's improvements to make us confer on him, with justice, the name of an illustrious man, but not to place him, as his partisans do, so far above all other men, standing the Buonaparte of science, admitting no equal, and suffering no rival. Each individual, however eminent, is directed in his exertions by public opinion, by times, and circumstances; and the most useful inventions are those called for by the wants of the moment, and to discover which a number of minds are directed. By slow and gradual improvements, sometimes chance-discovered, mingled, too, with many failures and rejections of what were afterwards found to be great advantages, has the steam-engine been brought to its present state. "It must be acknowledged," says the motto to Mr. Stuart's book, "that this is the most wonderful of all machines, and that nothing of the work of man approaches so near to animal life. Heat is the principle of its movements: there is in its tubes a circulation like that of the blood in the veins of animals, having valves which open and shut at proper periods; it feeds itself, evacuates such portions of its food as are useless, and draws, from its own labours, all which is necessary to its own subsistence." This wonderful machine, the perfecting of which is due to our own age and country, belongs as much by its origin as by its advantages, to the whole human race, the labour and the knowledge of many generations, existing in different parts of the world, having concurred in its creation.

HYDROCYANIC, OR PRUSSIC ACID.

In 1782 Scheele first taught the chemical world that the substance called Prussian blue, which had been then known somewhat more than seventy years, consisted of iron combined with a peculiar acid, which was afterwards named *prussic* by Guyton Morveau. The elder Berthollet and Fourcroy afterwards showed that this acid consisted of carbon, hydrogen, and nitrogen. Porrett attempted to assign the proportion of each,* and inferred the existence of another acid, which he called the *ferro-chyazic*; but it is to Gay Lussac that we are indebted for the knowledge that the prussic vapour, deprived of its hydrogen, forms a gaseous substance which is the basis of the prussic acid; and to which, for that reason, he gave the name of *cyanogen*. The acid formed by the union of hydrogen with this substance he termed *hydrocyanic acid*, and that resulting from the union of equal portions of chlorine and cyanogen the *chlorocyanic acid*.†

The prussic acid is extremely volatile; it boils at 79°.7 Fahr., under a pressure of 29.9 inches, and at 50° Fahr. it sustains a volume of mercury of 14.95; its congelation, however, takes place at 5°, but the cold it produces when allowed to evaporate in the open air, is sufficient to congeal it at the temperature of 68° Fahr. It is little soluble in water, but is easily dissolved by alcohol. It is readily decomposed, even when kept in close vessels and secluded from the light. There are two principal modes in which this acid is prepared; the one as used by Gay Lussac, and the other known by the name of Scheele's method. The latter is the one employed in this country, and the former on the Continent. We shall first give Gay Lussac's, and afterwards Scheele's method.

Hydrocyanic acid is obtained by digesting the crystallized deuto-cyanuret of mercury in two-thirds of its weight of liquid and slightly fuming hydrochloric acid, in a tubulated retort, which communicates with a receiver containing fragments of chloruret of calcium and chalk, and which itself com-

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* Carbon 24.8; hydrogen 34.5; nitrogen 40.7.

† Edinburgh Medical Journal, July 1824.

municates with a much smaller receiver, destined to collect the product. These receivers must be surrounded by a mixture of ice and salt. After the deuto-cyanuret of mercury and the acid have been successively put into the retort, a slight heat is to be applied; a little ebullition soon succeeds, arising in part from the evaporation of the prussic acid which is formed, and is condensed in the first receiver with a little hydrochloric acid and water. When the quantity of water becomes very sensible, the operation must be suspended, in order that the product already obtained may be purified; this is performed by isolating the first receiver from the retort, taking away the ice which surrounds it, and replacing the ice by water at 89°. 6 or 91°. 4 Fahr. Under these circumstances the hydrocyanic acid passes alone into the small receiver, for the water and hydrochloric acid which were at first volatilized with it, are now retained in the first receiver; the water by the chloruret of lime, and the hydrochloric acid by the lime.*

Scheele's process, as given by Mr. Thomson,† is as follows:—Mix two ounces of Prussian blue with six ounces of red precipitate of mercury, and add six ounces of water; boil the mixture for some minutes, constantly agitating it, when the blue colour will disappear, and the mass assume a yellowish-grey hue. Pour the whole on a filter, and wash the residuum with a little hot water, which is to be added to the filtered liquor. Pour this upon an ounce and half of clean iron filings, and add three drachms of strong sulphuric acid. Shake this mixture well, and after the powder subsides, pour the fluid into a retort, and distil one fourth part of it over a well luted receiver. This is the hydrocyanic acid, containing an admixture of a little sulphuric acid, which is readily separated by means of barytic water. La Planche recommends 1-6th only to be distilled over, and this to be rectified by means of a gentle fire, over 1-200th of carbonate of lime, distilling off afterwards, by means of a gentle fire, 3-4ths only of the whole. The acid is obtained of a uniform strength by this method, which is the one always used in this country, where it is given from four to fifteen drops in a dose. M. Majendie says, that the medical properties of prussic acid, prepared according to Scheele's method, are not sufficiently determinate, on account of the arbitrary nature of the process. It is better to use M. Gay Lussac's acid, taking care that it be properly diluted by adding six times its volume, or 8.5 times its weight of distilled water.

The action of hydrocyanic acid on the animal economy has not escaped observation, and within the last eight years its medicinal virtues have been carefully examined; but the means of detecting the presence of this acid in persons who have been poisoned by it have not been the subject of much investigation. Orfila, who has described with accuracy the action of this poisonous substance on the animal economy, the disorders which it occasions when taken in too large quantities, has made no researches whatever for the purpose of enabling one to discover traces of its presence on the dead subject. This is the more surprising on the part of Orfila, as his labours on the subject of poisons in general are unequalled, and the means of detecting their presence (more particularly, however, the mineral poisons) are laid down with great care and correctness. Hydrocyanic acid is one of the most powerful poisons in nature, the quantity sufficient to cause instantaneous death being very small; and the number of instances on record of its producing this calamity, form so many reasons why we should be acquainted with every test capable of detecting its

* Majendie's Formulary for the Preparation of new Remedies, translated by Thomas Haden, Esq., 2d edit. corrected by Dr. Dunglison.

† Edinburgh Dispensatory, p.23.

presence. Its smell, which is very strong, and similar to that of peach blossoms or bitter almonds, may lead one to suspect the presence of this acid, and in some cases we know has been considered conclusive, without any other evidence being adduced in support of its existence. But a paper has been lately read before the Royal Academy of Medicine at Paris, by M. Itard, in which some instances of the spontaneous development of hydrocyanic acid are mentioned. One person in whom this phenomenon was observed, laboured under inflammation of the bowels, and another under inflammation of the liver.' In both these cases the alvine evacuations smelt very strongly of bitter almonds. These facts are important, and show that this peculiar smell alone ought not to be received as positive proof of hydrocyanic acid having been taken. We know that some doubts have been raised whether the acid did or did not exist in the motions, although they smelt so strongly of it; and whether the smell might not have been produced by the presence of some other substance. M. Itard is open to this objection, for not having analyzed the fæces; but our position will not be invalidated even if the fæces, although they smelt so strongly of it, contained none of the acid. On the one hand, if there was any hydrocyanic acid in the fæces, that acid (the patients having taken none of it during their illness) was spontaneously developed: on the other hand, if there was none of this acid in the fæces, and they, nevertheless, smelt strongly of it, it only shows that a smell similar to that of hydrocyanic acid may exist in cases where there is none of the acid present, and also confirms what we have before advanced, that the smell alone of hydrocyanic acid ought not to be received as proof of its having been taken. Having made these few preliminary remarks, we shall now consider the action of this acid on the animal economy, the antidotes which have been recommended for counteracting its poisonous effects, and the tests that have been used for discovering its presence after death.

(To be continued.)

DICTIONARY OF CHEMISTRY.

Carbon Mineral. Charcoal united with earth and iron without bitumen; it is of a greyish-black colour.

Carbonates. Salts composed of carbonic acid and some base. Thus chalk and marble are carbonates of lime, consisting of lime and carbonic acid.

Carbonate of Barytes, *witherite, aerated heavy spar, aerated baroselenite, aerated heavy earth, barolite.* A mineral, being a compound of barytes and carbonic acid.

——— of Lime, *calcareous spar, marble, chalk, limestone.* Carbonic acid and lime.

——— of Strontian, *heavy spar, strontian.*

Carbon, Chlorides of. An interesting class of compounds, consisting of carbon and chlorine, and for a knowledge of which we are indebted to Mr. Faraday.

Carbonic Acid, *fixed air, aerial acid, mephitic acid, calcareous acid, choke damp;* a compound of carbon and oxygen, in the proportion of 28 carbon, 72 oxygen. In its uncombined state it exists in the form of a gas, is generally found in the atmosphere, and is a very general product of combustion. It is much denser than common air, and hence occupies the lower part of caverns and mines whereever it is produced, and renders them destructive of life. It abounds in a fixed state in nature, and forms a large part of lime-stone, marble, and calcareous spar.—It is emitted in large quantities during vinous fermentation, and gives a sparkling appearance as well as a sharp pleasant taste to many fermented liquors. To the discovery of this acid and of its compound nature, much of the progress of chemistry during the last century was owing; and the

labours of a variety of chemists were instrumental in obtaining the result.

Carbonic Oxide. A gaseous compound, consisting, like carbonic acid, of carbon and oxygen, but containing only half the oxygen that exists in carbonic acid, or it consists of 43 carbon and 57 oxygen in 100 parts. It was one of the latest discoveries of Dr. Priestley, and is obtained by subtracting oxygen from carbonic acid. When this oxide is breathed it is destructive of life. Sir H. Davy inspired it mixed with atmospheric air, was severely affected at the moment, and did not recover for several days. Mr. Witter, of Dublin, was struck as by an apoplectic fit from breathing it, but was speedily restored by breathing oxygen.

Carburets. Compounds of carbon and a salifiable base.

Carburet of Manganese, *keesh.* A substance occasionally met with in iron foundries, being a compound of carbon and the metal.

——— of Sulphur, *sulphuret of carbon, alcohol of sulphur.* A fluid obtained by distilling pulverized pyrites and charcoal in an earthen retort. It is a compound of sulphur and carbon, and may be considered as a curious illustration of the effects of combination, in changing the nature of substances; for in this case two bodies which are usually in the solid state, form, by their union, a fluid which may be cooled down to 80° below Zero without becoming solid.

Carburetted Hydrogen Gas, *bihydroguret of carbon, heavy inflammable air, fire damp.* A compound of hydrogen and carbon. This gas exhales in mines and from stagnant water; the gas obtained from coal for lighting the streets is carburetted hydrogen mixed with hydroguret of carbon, or olefiant gas and carbonic oxide.

SPAWNING OF SALMON.

Spawning is not the only purpose for which salmon leave the sea. They find food in the estuaries of rivers, and they go into the fresh water to get rid of the sea louse. But those which have been long in fresh water have often their gills almost eaten through with another species of vermin, called maggots.

The following is their mode of depositing the spawn:—"They proceed to the shallow waters, generally in the morning, or at twilight in the evening. They play round the ground two of them together. When they begin to make the furrow, they work up the gravel rather against the stream, as a salmon cannot work with his head down the stream, for the water going into his gills the wrong way drowns him; and when they have made a furrow, they go a little distance, the one to the one side and the other to the other side of the furrow, and throw themselves on their sides when they approach, and shed their spawn into the furrow at the same time. I have seen three pair upon a spawning bed at a time, and have stood and looked at them, both while making the furrow and laying the spawn." They do not lay the spawn all at once, but from time to time in eight to twelve days. When they are done they go into a pool to recruit themselves. About a fortnight or three weeks after this, the male begins to seek his way down the river. The mother fish remains longer, sometimes till the first fry come down, in March or April. He has seen these *kelts*, or mother fish, with the skin rubbed off below the jaws, in consequence of ploughing up the gravel. The fry come into life from 10th March to 10th April, and in the Tay they have generally all descended to the sea by the end of May. He estimates the number of *ova* in a salmon to be from 17,000 to 20,000, each of which may become a fish. He holds the herlings of Annan, the whitings of Carlisle, and the finnocks of the north, to be all the same fish, and distinct from the salmon. The *grilse* also he considers to be quite a different species of fish from the salmon, but similar in their habits. They go up the rivers to spawn,

and come down *kelts*. The same remark applies to the sea trout. He has taken in one draught, kelt salmon, kelt grilse, kelt trout, and kelt herlings.—*Evidence of Mr. Halliday, before the Committee on Salmon Fishery.*

MUSICAL FISH.

The following account of a musical phenomenon, supposed to be produced by fish, may not be unacceptable to our readers. It is taken from Lieutenant White's History of a Voyage to the China Sea, and occurred to him at a spacious estuary on the Douai river, in Cochin China:—"Our ears were saluted by a variety of sounds resembling the deep bass of an organ, accompanied by the hollow guttural chant of the bull frog, the heavy chime of a bell, and the tones which imagination would give to an enormous Jews'-harp. This combination produced a thrilling sensation on the nerves, and, as we fancied, a tremulous motion in the vessel. The excitement of great curiosity was visible on every face on board, and many were the sage speculations of the sailors on this occasion. Anxious to discover the cause of this gratuitous concert, I went below, where I found the noise, which I soon ascertained proceeded from the bottom of the vessel, increased to a full and uninterrupted chorus. The perceptions which occurred to me on this occasion were similar to those produced by the torpedo or electric eel, which I had before felt; but whether these feelings were caused by the concussions of sound or by actual vibrations in the body of the vessel, I could neither then nor since determine. In a few moments the sounds, which had commenced near the stern of the vessel, became general throughout the whole length of the bottom. Our linguist informed us that our admiration was caused by a fish of a flat oval form, like a flounder, which, by a certain conformation of the mouth, possesses the power of adhesion to other objects in a wonderful degree, and that they were peculiar to the Seven Mouths (the part of the river where we then were); but whether the noises we heard were produced by any particular construction of the sonorific organs, or by spasmodic vibrations of the body, he was ignorant. Very shortly after leaving the basin, and entering the branch through which our course lay, a sensible diminution was perceived in the number of our fellow-travellers, and before we had proceeded a mile they were no more heard. On the ship's return down the river, the same submarine serenade again saluted the ears of the crew at the same spot."

EFFECT OF OXYGEN ON GLOW-WORMS.

It is an interesting experiment, (says Mr. Parkes) to place a glow-worm within a jar of oxygen gas in a dark room. The insect will shine with much greater brilliancy than it does in atmospheric air. As the luminous appearance depends on the will of the animal, this experiment probably affords an instance of the stimulus which this gas gives to the animal system.

TO CORRESPONDENTS.

The request of A Young Admirer of Chemistry *has been attended to.*

Persons desirous of purchasing a small collection of chemical apparatus cheap, may hear of such, we are informed by a Correspondent, at Mr. Sinclair's, 24, Rathbone-place, Oxford-street.

We shall hereafter notice Tanning.

T. R. S. in a future Number.

If A Subscriber *will point out the date of the patent he alludes to, we will attend to the subject.*

Erratum *in* Chemist, No. XXVI. page 406, *bottom line, for* species *read* weight.

*** *Communications (post paid) to be addressed to the Editor at the Publishers'.*

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The Chemist.

"——Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if nought in these external scenes
Can move thy wonder?——"

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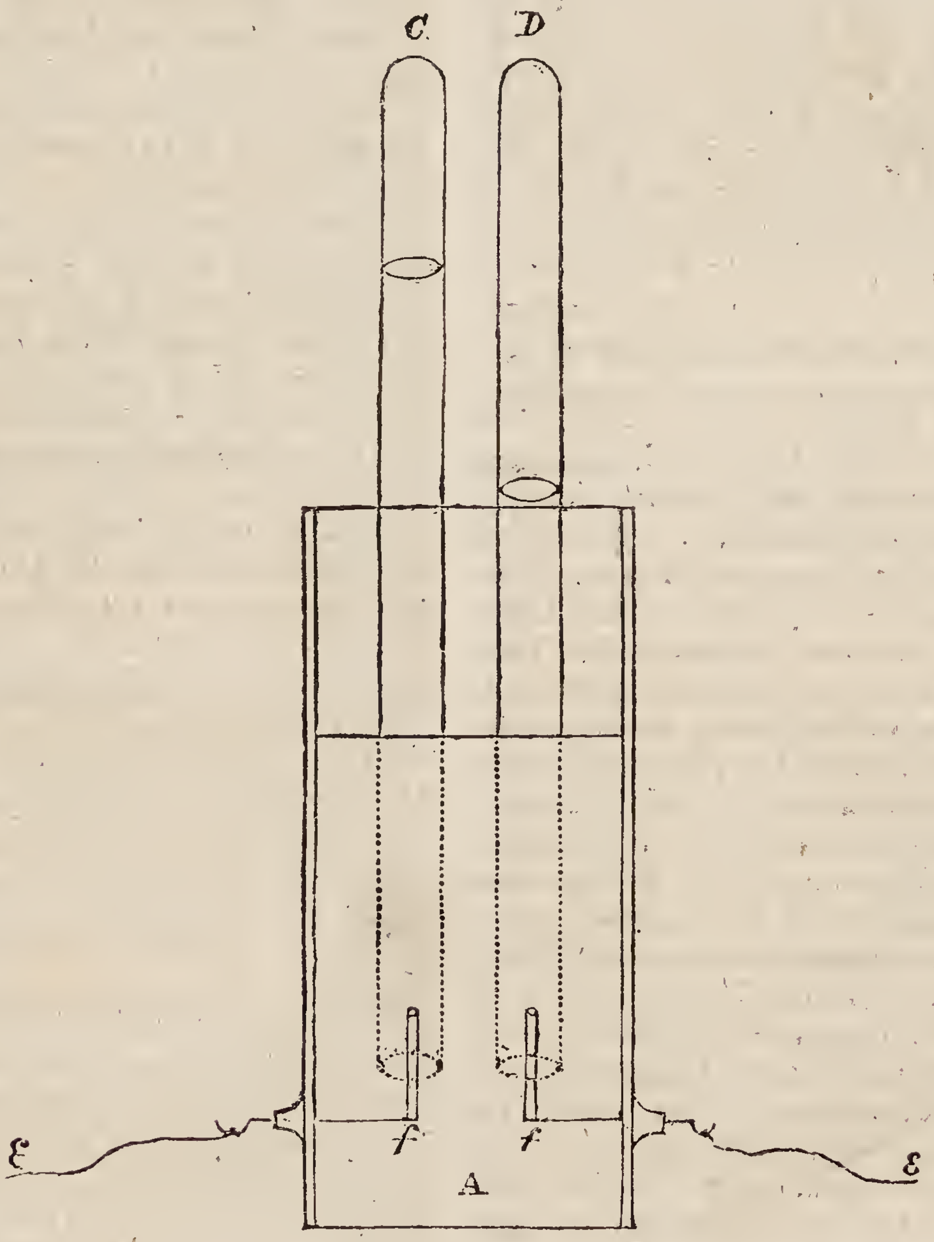

CONTENTS.

DECOMPOSITION OF WATER.

(*From a Correspondent.*)

A is a glass partly filled with pure water; C D are two tubes, open at one end; *f f* are two pieces of platina foil; E E are wires attached one to each end of the galvanic trough. The two tubes are held in their places by passing through corks at the top. When put in the position above represented, and the two wires attached to the battery, the products are obtained separately in the two tubes. The wires which pass through the sides of the glass are brass, to which the platina foil is attached; the brass wire must be covered with sealing-wax, as far as the junction with platina, to prevent the brass from being oxidated from the decomposition of the water.

PROFESSOR LESLIE ON LIGHTNING CONDUCTORS.

Professor Leslie has lately published, in the Edinburgh Philosophical Journal, a paper on Electrical Theories, in which he denies, and very justly, that there is any reason whatever for supposing that an electrical *fluid* exists. He also endeavours, in an ingenious manner, to account for all the phenomena of electricity, without supposing there is a separate fluid. We are not so certain that his explanation is correct, as we are that his denial of the old theory is well founded. He seems to suppose, that the air is the conducting body, and that what are called currents of the electrical fluid are only currents of air in an electrical state. We shall not discuss the merits of this theory, but lay before our readers what he says of lightning conductors:—

" But, whatever speculations we may form in regard to electrical light, and the mode in which the point and the knob produce their different effects, we must admit that the *electricity is never communicated, in any perceptible degree, to a remote and unconnected body, but by means of a current of air*;* and this established principle will enable us to estimate the real effects of conductors or thunder-rods.

" When two portions of air, near the point of saturation, and of different temperatures, are mixed, a quantity of the dissolved vapour is precipitated, and resumes its aqueous state. By this conversion the mass acquires electricity; and the consequent repulsion exerted tends to disperse the minute globules of water, which will float in the atmosphere, or rather, will descend with that slow motion which is sufficient to occasion a resistance on their large surface equal to their gravitation. If the cloud † thus generated reach the ground, it will soon communicate its electricity. If it be suspended at some height, the electrified air will stream from it in all directions; and if its formation be gradual, this discharge may suffice to waste its force. But when a vast cloud is suddenly formed, the aërial emission hardly impairs its electricity; and as it is carried along, it continually approaches, by its attraction, to the surface, which assumes an opposite electricity; the air now rushes with violence, and the cloud bends faster downwards, till at last its lowest verge reaches the ground, and a total discharge is made. The magnitude of the stroke will evidently depend on the extent of the aqueous mass, the suddenness of its precipitation, and the rapidity of its descent.

" The air, which streams in all directions from the cloud, is dissipated among the more remote portions, and thus gradually communicates its electricity. Hence, from the wide dispersion, owing to the distance, the electricity of the air at the surface of the earth must be weak; and, even in the midst of

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* The reader will bear in mind, that this is the Professor's theoretical assumption.

† It is a common observation in the country, that, after a thunder-cloud has passed, the wind still blows from the cloud, though in an opposite direction.

the storm, the electrometer is less affected than if placed only a yard behind the prime conductor. Yet the action of the thunder-rod is confined entirely to the air which immediately surrounds it, and the quantity of aërial current which it can produce, must evidently be inferior to what is directed to the point, when held several feet from the conductor of an electrical machine. But to avert the stroke, it would be necessary that the whole air between the surface and the cloud should be brought successively in contact with the top of the rod. Nor is this all; for the air will be constantly replaced by other electrified portions emitted from the cloud. The effect of the thunder-rod is therefore, comparatively, but a drop in the ocean.* It may be easily shown, that, however pointed and tapered, it would require a thousand years to guard at the distance of an hundred yards; if terminated with a knob, it might take ten thousand years. Such are the vaunted performances of thunder-rods, and such the advantages of their different forms! †

Nor can we appeal to experience; it never can be proved that thunder-rods have produced beneficial effects, but several instances may be cited where they have afforded no sort of protection.* Nay, we shall be convinced, that fully an equal proportion of the buildings armed with such supposed safeguards have been struck with lightning. But if thunder-rods are useless, they are also innocent; and that they provoke the shaft of heaven, is the suggestion of superstition rather than of science. The cloud exerts an attraction, indeed, upon the surface of the ground, but the force depends solely on the distance, and is not, in the least degree, affected by the shape or quality of the substances below. It rolls towards the nearest and most elevated objects, and strikes indiscriminately a rock, a tree, or a spire.

"If a thunder-rod be then a harmless, though idle appendage of a house, why awaken uneasy apprehensions? It might at least inspire confidence in the moments of danger; and if happiness consists merely in idea, why not in-

* It appears, from the experiment with the heated ball, (an experiment to prove that, by means of heat, a ball may be made an equally good conductor with a point,) *that a good kitchen fire has more efficacy in preventing a house from being struck*, than a whole magazine of thunder-rods. Hence one of the reasons why a thunder-cloud diminishes so fast in passing over a large city.

† The utility of thunder-rods not being once questioned, it was yet keenly disputed in England for several years, whether these should be terminated by *points* or by *knobs*. But, what is amusing, politics soon came to be mixed up with the controversy. The powder magazine at Purfleet, though guarded by pointed conductors, happening, in 1778, to be struck by lightning, the Privy Council made an application to the Royal Society to investigate the cause of this accident. A Committee was accordingly named of its ablest members, who, still adhering to the hypothesis of Franklin, only recommended additional pointed conductors to be placed at nearer intervals. This Report, in the height of the revolutionary war, could not be otherwise than displeasing to the courtiers, who, from their violent antipathy to the American philosopher, were as eager to depreciate his science as to deride his patriotism. They accordingly set on foot a subscription to enable Mr. Wilson to perform electrical experiments on a large scale in the Pantheon, and the conclusions thence drawn seemed favourable to the theory of knobs. The Royal Society was in consequence *desired* by high authority to revise their Report; but the President, Sir John Pringle, replied with some warmth, that *he could not change the laws of nature!* This venerable person, however, being worried on all sides, soon resigned the chair in disgust, and retired into the country.

* At the very moment the Professor is so stoutly denying the utility of thunder-rods, some of the *savans* of the French Institute, by the *command* of the minister of the interior, have formed themselves into a committee to ascertain the best shape and form for these instruments; and the result of their labours has lately been brought before the public, in a very elaborate memoir, contained in the *Annales de Chimie et Physique*.

dulge delicious error? Yet, though the inevitable stroke cannot be turned aside, its destructive effects may be lessened; and an investigation of the real action of thunder will conduct us to the proper principles."

We have some doubts of the accuracy of this theory. The Professor states, that when the "lowest verge of the cloud touches the ground, a total discharge is made;" and also, "that the cloud rolls towards the nearest and most elevated objects." We would, therefore, beg leave to ask, when a communication is established between the earth and the cloud by a lightning conductor, if a total discharge will not be made? if this, in fact, does not take place on a small scale in all discharges of the electrical machines; and, in fact, whenever a cloud comes in contact with a tree, a rock, or a spire? We would further ask, if a lightning conductor may not, like a tree or a spire, establish a connexion between the earth and the cloud, and discharge it? But the Professor gives up the only practical point worth contending for, when he recommends that ribands of copper should be extended from masts of ships to their keels. We have no theory on this subject, and do not pretend to account for these facts; but if they are correct, the Professor's objections to lightning conductors are unsatisfactory. We believe, nobody ever expected that a rod should equal a mountain in capacity; but it may harmlessly communicate the electrical stroke from a cloud to the ground, and carry that stroke past the house. At the same time, we readily admit that he has stated so many circumstances which show the possibility of opposing currents of air carrying off electricity, that we cordially subscribe to the notion of a rousing kitchen fire being a good preventive against a house being struck, and wish that all men were in a condition to employ so cheerful a guard.

ACTION OF HYDROCYANIC ACID ON THE ANIMAL ECONOMY.

As a medicine this acid has been extensively tried in France, Germany, Italy, and our own country, and several treatises have been published extolling its virtues, and describing the wonderful effects which it is capable of producing. It is chiefly efficacious in complaints of the chest, and its exhibition, even in these affections, requires (as we have been informed) considerable discrimination. But this, like many other remedies which have been indiscriminately praised, does not enjoy the extensive reputation it once did. When a new remedy is proposed, its virtues are frequently overrated. The cases in which it is tried happen to be benefited during its exhibition, and the new medicine gets the credit; other causes, which may have materially assisted, being left out of the question. Indolent persons, glad to have any excuse for not exerting themselves, seeing that the vaunted remedy does not answer their expectations, readily cast it aside, without endeavouring to draw a line of distinction between the cases in which it is of use and those in which it is mischievous. Thus from misdirected enthusiasm on the one hand, and indolence on the other, really valuable remedies often meet with neglect. This medicine, when taken in too large doses, produces instantaneous death. From the *Annales de Chimie* for October 1814, we learn that a professor of chemistry inadvertently left on his table a phial filled with a solution of prussic acid in alcohol, and that a female, seduced by its agreeable smell, drank a small glass full of it, and soon expired, as if struck by apoplexy. In Dr. Granville's Treatise* on this acid, we find the following case; it is taken from Hufeland. D. L. a robust and

* Historical and Practical Treatise on the Internal Use of the Hydrocyanic Acid, by A. B. Granville, M. D., &c. &c. London 1820.

healthy man, aged thirty-six years, on being seized as a thief by the police officers, snatched a small sealed phial from his pocket, broke off the neck of it, and swallowed the greatest part of its contents. A strong smell of bitter almonds soon spread around, which almost stupified all present. The culprit staggered a few minutes, then, without a groan, fell on his knees, and sunk lifeless on the ground. Medical assistance being called in, not the slightest trace of pulse or breathing could be found. A few minutes afterwards, a single and violent expiration occurred, which was again repeated in about two minutes. The extremities were perfectly cold, the breast and abdomen still warm, the eyes half open and shining, clear, lively, full, almost projecting, and as brilliant as those of the most ardent youth under violent emotion. The face was neither distorted nor convulsed, but bore the image of quiet sleep. The corpse exhaled a strong smell of bitter almonds, and the remaining liquid being analyzed, was found to be a concentrated solution of prussic acid in alcohol. Several cases are also on record of poisoning by the distilled water of the cherry laurel, the leaves of this plant, and the essential oil of almonds, which we have not room to insert.* All of them, however, show the dreadful effects which substances containing the prussic acid are capable of producing. The *modus operandi* of hydrocyanic acid appears to be through the medium of the nervous system; and we will here relate one or two of the experiments made with this substance on animals, by M. Orfila,† to show the symptoms it produced.

Experiment 1st. Two drops of prussic acid were given to a young dog; immediately afterwards the respiration was accelerated, its step became unsteady, the animal fell, made water in abundance, and vomited twice; in a short time it recovered. In five hours' time eight drops more were given to it, when the animal instantly experienced the following symptoms: — cough, flow of saliva, quickened respiration, weakness of the hinder extremities, plaintive cries, purging, bending of the body backwards, dilatation of the pupils, rigidity of the muscles, and in less than five minutes, paralysis of the hind feet first, then of the fore feet; general insensibility, excepting of the rump, which was occasionally agitated; accelerated pulse, from 72 to 150 in the minute, great mobility of the eyes and eyelids, and at last complete stupor. Fifteen minutes after this the animal arose, voided its urine, bent the body backwards, and in half an hour was restored. On the following day, sixteen drops of the same poison were again given to this animal. Instantly, quickened respiration, very violent cries, convulsions, opisthotonos (bending of the body forwards), then emprosthotonos (the contrary motion), the fore feet placed on the head, general tetanus, dilated pupils, ears stiff, urine copious, general paralysis, lapping of the tongue, eyes fixed, eyelids in motion. Five or six minutes afterwards, respiration difficult, trismus irregular and unexpected movements. At the end of half an hour the animal raised itself, and appeared to suffer in the stomach; was frightened at the least noise, sought the dark, and greatly trembled. One hour after, it ate with a voracious appetite.

Experiment 2d. When thirty or forty drops of prussic acid were administered to dogs or cats, they put forth cries more or less violent, had convulsive motions, and expired six, twelve, or fifteen minutes after taking the poisonous substance.

On examining the bodies of animals or persons poisoned by this acid, no traces of inflammation are to be observed; there is congestion of the veins, whilst the arteries are empty. We are not

* Vide Paris and Fonblanque on Medical Jurisprudence, vol. ii. p. 400.

† Traité des Poisons, par M. P. Orfila, tom. ii. p. 168.

aware that any antidote against this poison has been successfully employed; vinegar, or the vegetable acids, coffee, a solution of chlorine in water, camphor, emollient drinks, and bleeding, have all been recommended, but their power in counteracting the effects of this poison has not yet been proved.

The chemical processes by which the presence of hydrocyanic acid may be detected require careful consideration, as in cases where this poison is suspected to have been given with intent to kill, the life of an individual may depend on the nature of the testimony which is given respecting it. Dr. Granville, in the treatise which we quoted above, gives the following directions in conducting the experiments, which should be strictly observed:—After collecting the blood contained in the ventricles of the heart, a portion of the contents of the stomach and of the superior intestines, together with a certain quantity of any fluid which may chance to be present within the cavity of the head, chest, or abdomen; and having agitated the mixture for some time in distilled water, and filtered the liquid, taking care to keep the whole at a low temperature, proceed to the following experiments:—

1. To a small quantity of the liquid supposed to contain the acid, add a few drops of a solution of caustic potash in alcohol.

2. To this a few drops of a solution of sulphate of iron must be added, when a cloudy and reddish precipitate, of the colour of burnt *terra sienna*, will fall down.

3. Some sulphuric acid is now to be introduced into the tube, when the colour of the precipitate will instantly change to that of a bluish-green, which, by a permanent contact with the atmosphere, becomes gradually of a beautiful blue, assuming at the same time a pulverulent aspect, if there be any acid present. Or,

1. Treat the filtered liquid with carbonate of potass.

2. Add a solution of sulphate of iron with a small quantity of alum: a precipitate, as in the former method, will fall down, which, if treated by free sulphuric acid, will also become blue and pulverulent. During this latter part of the experiment there is a disengagement of carbonic acid.

Evidence may be pushed still farther, and the existence of the prussic acid proved in a most positive manner, by decomposing the precipitate above described, and which is a true prussian blue, so as to separate the acid. For this purpose, heat the precipitate with an equal quantity of tartaric acid in a glass retort, at the temperature of 150°, when the hydrocyanic vapours will soon exhale from the mixture, and may be received in water.

A test by which the presence of a smaller quantity of this acid than can be discovered by the two preceding experiments, has been lately suggested and tried by M. Lassaigne, at Paris. The test made use of consists of the sulphate of copper instead of the sulphate of iron, and the experiment is conducted in the following manner:—

1. Into the liquid supposed to contain the hydrocyanic acid some potash is to be put, so as to slightly alkalize it.

2. To this a few drops of a solution of sulphate of copper are to be added.

3. On the addition of sufficient hydrochloric (muriatic) acid to redissolve the excess of oxide of copper which has been precipitated by the alkali, the liquid instantly assumes a milky appearance, more or less intense, according to the hydrocyanic acid which it contains.

The advantage of the sulphate of copper consists in its detecting much more minute quantities of the acid than the sulphate of iron, and with greater rapidity. We cannot conclude this article without stating that the nitrate of silver will be found a very delicate test for discovering in distilled water

the existence of the hydrocyanic acid; but as the product which is obtained possesses properties which are common to it and the chlorate of silver, with which it may be confounded, the copper is to be preferred.

CIRCULATION OF THE BLOOD.

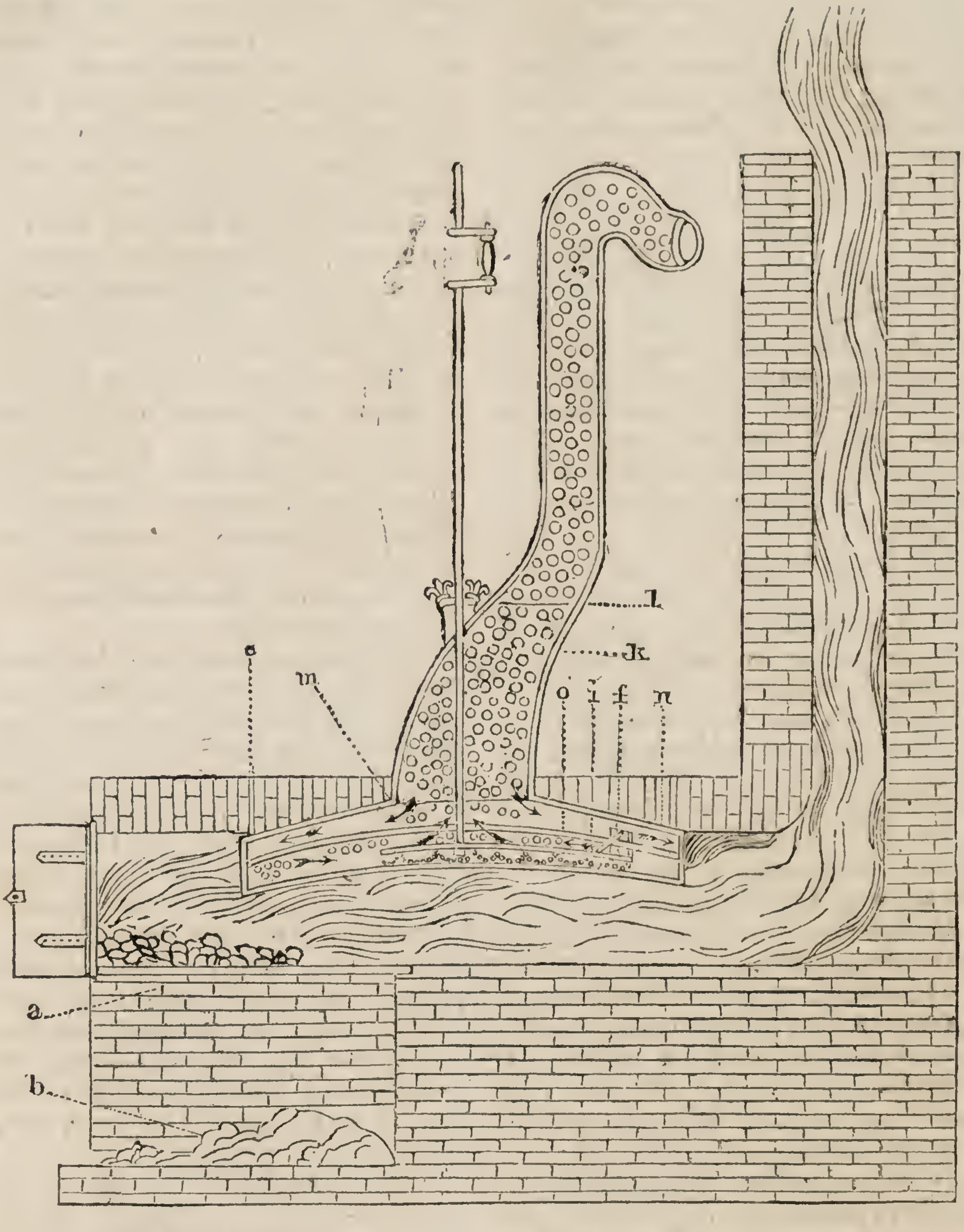
The following eloquent description of the circulation of the blood, by Dr. Paley, may not be unacceptable to the youthful readers of The Chemist, particularly as its pages have lately contained a dry, but we hope correct account of the process of respiration and animal heat.

"There is provided in the central part of the body a hollow muscle, (the heart) invested with spiral tubes, running in both directions. By the contraction of these fibres, the sides of the muscular cavities are necessarily squeezed together, so as to force out from them any fluid which they may at that time contain: by the relaxation of the same fibres, the cavities are in their turn dilated; and, of course, prepared to admit every fluid which may be poured into them. Into these cavities are inserted the great trunks, both of the arteries which carry out the blood, and of the veins which bring it back. This is a general account of the apparatus: and the simplest idea of its action is, that by each contraction a portion of blood is forced as by a syringe into the arteries; and at each dilation an equal portion is received from the veins. This produces, at each pulse, a motion and change in the mass of blood to the amount of what the cavity contains, which in a full-grown human heart is about an ounce, or two table-spoons full. Each ventricle will at least contain one ounce of blood. The heart contracts four thousand times in one hour; from which it follows, that there pass through the heart every hour four thousand ounces, or 350lbs. of blood, troy weight. Now the whole mass of blood is about 25lbs.; so that a quantity of blood equal to the whole blood within the body passes through the heart fourteen times in one hour; which is about once every four minutes. Only consider what this is in very large animals. The *aorta* of a whale is larger in the bore than the main pipe of the water-works at London Bridge; and the water roaring in its passage through that pipe is inferior in impetus and velocity to the blood gushing from the whale's heart." According to Dr. Hunter, ten or fifteen gallons of blood are thrown out of the heart of a whale at a stroke, with an immense velocity, through a tube of a foot diameter. The whole idea fills the mind with wonder. See Dr. Hunter's account of the dissection of a whale, in the Philosophical Transactions.

"It was necessary that the blood should be successively brought in contact or proximity with the air; therefore, as soon as the blood is received by the heart from the veins of the body, and before that it is sent out again into its arteries, it is carried by the force of the contraction of the heart, and by means of a supplementary artery, to the lungs; from which, after it has undergone the proper change, it is brought back by a large vein once more to the heart, in order, when thus prepared, to be from thence distributed anew into the system.

"An anatomist, who understood the structure of the heart, might say beforehand that it would play: but he would expect, I think, from the complexity of its mechanism, and the delicacy of many of its parts, that it would always be liable to derangement; or that it would soon work itself out. Yet shall this wonderful machine go, night and day, for eighty years together, at the rate of a hundred thousand strokes every twenty-four hours, having at every stroke a great resistance to overcome; and shall continue this action for this length of time without disorder, and without weariness."—*Paley's Natural Theology.*

Fig. 1.



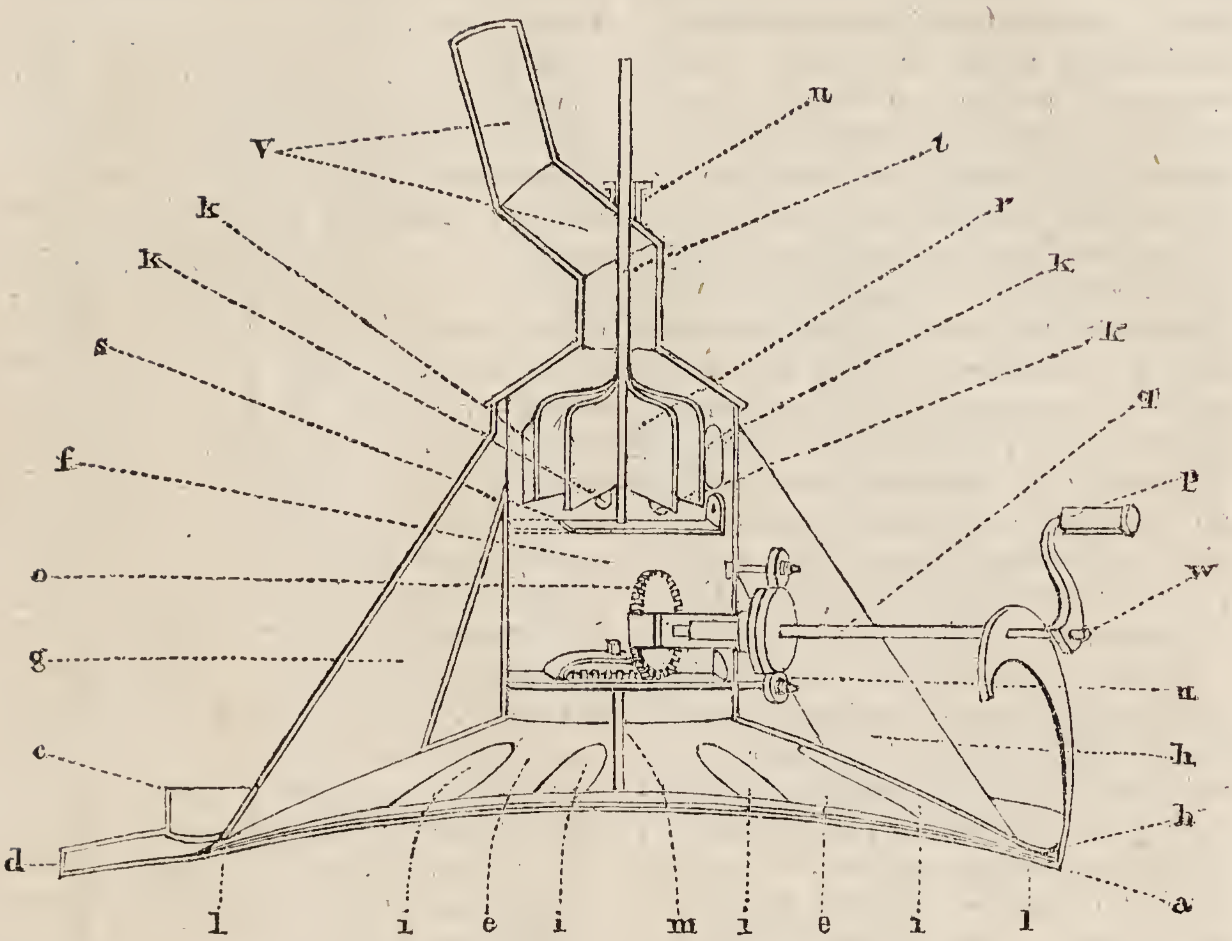
DISTILLATION.

Art. IV.

ALCOHOL.

We now come to that part of this complicated process which is, properly speaking, the distiller's art, viz.—the art of extracting the greatest possible quantity of spirit, of the most agreeable flavour, from the fermented liquid, whether that is obtained from ripe fruits, or from the process of malting and fermenting grain. It has been already mentioned, both in the first article on distillation, and in the last, that the alcohol exists ready formed in the wine and in the wash, combined with other substances; and the art of distillation therefore consists in separating the alcohol from the other substances in the cheapest and best manner. It is an established fact, that alcohol boils at a temperature at least forty degrees below the boiling point of water, and consequently it is volatilized much sooner than any of the other ingredients, except, perhaps, the peculiar volatile oils to which the different spirits owe their flavours, with which it is combined. The object is, to apply this degree of heat, and no more, to the mixture containing the alcohol, so that it may be separated, and nothing carried over with it. In

Fig. 2.



general, however, this principle has not been strictly attended to, and a far greater degree of heat has been applied than is necessary to vaporize the alcohol. Thus, according to the mode of distillation at present in use in England, the process has to be repeated. What is first obtained is termed low wines, which, on being again distilled, yield raw spirit, and this gives, by a third distillation, the rectified spirit. All the writers on the subject, and all practical men agree in opinion, that the application of heat should be gradual, and not be increased beyond the degree necessary to separate the alcohol. Two evils, in fact, arise from the employment of too much heat. The first is to separate some empyreuma with the spirit, giving it a harsh, burnt, disagreeable taste, from which it can never be entirely freed; and the second is the greater quantity of time and trouble required to condense the spirit. These principles being admitted, our readers will hear with wonder that the excise laws of England have been so framed as to make it for the interest of the distiller to work with a greater degree of heat than necessary to separate the alcohol; first compelling him, as already stated, to make a more concentrated wash than is proper for making a mild, bland, salutary spirit, and then inducing him to distil that with the greatest possible rapidity, and with as much heat as he dared to apply. Nay, after the impolicy of these regulations has been shown, after a more economical and better system has been invented, and patents taken out to carry it into effect, the excise regulations, we have been informed, interfere, and absolutely compel the manufacturer to proceed in an unskilful manner, wasting both time and money, and producing a bad commodity.

The liquors resulting from distillation are known to most of our readers under the various names of brandy, rum, gin, hollands, whisky, arrack, &c., as they are procured from different substances. Brandy is obtained by distilling wine, rum by distilling the fermented juice of the sugar-cane, whisky, gin, and hollands, as well as what is called corn brandy, *schnaps*, *aqua vitæ*, &c,

&c., in various parts of Europe, are the product of a fermented infusion of malt or grain. From whatever substance these intoxicating liquors are procured, they consist principally of three ingredients, namely, water, pure spirit, or *alcohol*, and a peculiar oil, to which each spirit owes its peculiar flavour and colour. The principle in all is alcohol, which has been obtained nearly in a state of purity by chemical processes. Lowitz, of Petersburgh, was the first person to hit upon a method of procuring this substance in a very nearly pure state, and his process is as follows:—

Take a quantity of fixed alkali, perfectly dry, and still warm, and nearly fill with it a retort; upon this pour such a quantity of alcohol, previously separated as much as possible from water, by means of salt of tartar, as the alkali will completely absorb, so that the whole shall have the appearance of a solid mass, with no spirit floating above it: about two parts of alkali and one alcohol are the proportions requisite. Allow the mixture to remain twenty-four hours, and then distil by so moderate a heat that about two seconds elapse between the falling of each drop of alcohol from the beak of the receiver. When this interval increases, remove the receiver, for the strongest spirit has then all come over. By this process, Lowitz obtained alcohol of the specific gravity of 0.791, at the temperature of 68°. This *principle* of all intoxicating liquors is transparent, colourless as water, of a pleasant smell, and a strong, penetrating, agreeable taste. In general, the alcohol, rectified spirit, or spirit of wine of commerce, is mixed with a considerable quantity of water, and its specific gravity is consequently higher than what we have just stated. The specific gravity of spirits, therefore, is employed as a test of their relative purity, and in all experiments in which alcohol is concerned, it is always necessary to mention its specific gravity, or otherwise numerous errors may be occasioned.

We have already, No. XVII., given the form of a common still, with its condensing tub, and whether this or another still is employed, the principle of separating the spirit is the same. The wash, prepared as already described, is put into the still so as to fill it nearly three-fourths full, including the head. A piece of soap is usually put in with it, which, spreading on the surface of the boiling liquid, breaks the large bubbles, and checks the tendency to froth. Heat is immediately applied, and is continued as long as the liquid furnishes a spirit of a certain strength. To ascertain this point, an hydrometer is used, and when the spirit is of a certain weakness, the process is stopped by opening the stop-cock which issues from the bottom of the still, and the spent wash is removed. The low wines, or the first product of distillation, contain about 20 per cent. of alcohol, of the specific gravity 0.825, and are themselves about 0.975. Of course, pure alcohol is never obtained by the ordinary methods of distillation, and all the spirits of commerce is mixed with a large quantity of water. Indeed, the manufacturer is hindered by law from selling a stronger spirit than that of the specific gravity 0.909, or from 1 to 10 over hydrometer proof. It is calculated that 100 gallons of malt or corn wash will produce twenty of spirit, containing 60 parts of alcohol to 50 parts of water; cyder wash yields about 15 gallons, and molasses wash about 22. "A very good wine," says Chaptal, "gives one third of its weight in brandy. In Languedoc the average produce is a fourth. The wines of Bordeaux give a fifth, those of Burgundy still less. Brandy procured from old wines is better than that procured from new. Sweet wines furnish an excellent spirit. Sour wines give a bad spirit, mixed with malic acid, from which it cannot be freed." In this circumstance our readers will see a sufficient reason why the vinous

fermentation of grain and barley should never be carried so far as to run into acetous fermentation, and form vinegar. The above quantities are to be considered as what are obtained in practice, and this of course depends very much on individual skill.

In putting up a *still*, the bottom part of which must be regarded only as a means of applying heat to a liquid in the most economical manner, attention must be paid to its form. Chaptal recommends that the bottom should be concave, and both fuel and time are saved by having the still very broad and shallow, and contriving a free exit for the steam. In consequence of the regulation which made the amount of duty depend on the capacity or measurement of the still, it was the distiller's interest to work off the greatest quantity of spirit possible in the shortest space of time; and hence a form of still was adopted in Scotland well calculated to run off a great quantity of spirits in a short time.

Fig. 1 is a section of a common flat still, calculated to answer this purpose. It has an engine for agitating the sediment and a steam plate. *a* is the grate; *b* the ash-pit; *c* the furnace door; *d* the fire, showing the flame bent backwards, and away from the still, by the air which occupies the space between the fire and still; *e* the body of the still; *f* the bottom and side scraper; *g* its upright shaft; *h* the cup-mouthed aperture in the head of the still. through which the shaft enters. This cup is filled with wool and grease held down by a plate of metal, which is held down by two screws. *i* the copper plate, concave below, and stretching almost to the side of the still; *m* the large central hole in this plate, through which the air generated at the bottom of the still rises and escapes up into the head; *n* the arrows represent the current of the liquor in the still above and below the plate; *k* the head of the still; *l* the steam; *o* the chains of the scraping-machine.

Fig. 2 is an improved still of the same species, with its sediment agitating and jet-breaking apparatus. *a* the still; *b* the turned up edge of its circular bottom; *c* one of the lateral steam-escape pipes; *d* the central steam-pipe; *e* the discharge-pipe. The charge-pipe being on the opposite side could not be shown. *f* the head, luted on, and held down by the chain, *g*. There is a similar chain on the other side of the support of *i*, the lying shaft of the bottom scraping-engine. *k* the cup-like aperture in the head; *l* its cover; *m m* its screws; *n* the upright shaft of the jet and froth-breaker contained in the head, *f*, and upper part of the central pipe opposite to the entrance of the lateral steam-pipes, *c*; *o* the connexion between the shaft of the horizontal wheel, *p*, which is moved by the vertical wheel, *q*; *r* the handle of *q*; *s* the fly-wheel; *t t w w* the frame.

The particular motive which led to the invention and employment of this kind of still was to overreach the excise. The manufacturer was obliged to pay a duty in proportion to the capacity of his still. A committee of the House of Commons inquired into all the circumstances connected with distillation in 1798; and even with a knowledge of the first still we have described, it was supposed it could not be worked off in less than eight minutes. By subsequent improvements, however, the power was so increased, that it could be worked off and discharged in less than four minutes. In one instance it was satisfactorily proved, that a still measuring 43 gallons, and containing 16 gallons of wash, was charged and worked no less than 480 times in the space of 24 hours.

The following is Chaptal's description of another and a more economical mode of distilling:—

"The new distilling apparatus is a complete Woolfe's apparatus. It consists of a copper fixed in a furnace, and a series of round cauldrons, which communicate with one another by means of tubes, the whole being terminated by a worm. Wine is put in the first copper, and

in all the vessels between it and the worm. The head of the still plunges into the liquid of the first vessel to the depth of 10 or 12 inches. From the empty part of the first vessel a tube passes into the liquid contained in the second, and is inserted as deep as in the first. From the second another tube goes in like manner; and from the last a tube connects the apparatus with the worm, which is cooled in the usual manner. When the wine contained in the first vessel is heated, the *vapours* which rise pass into the second, and communicate a sufficiency of heat to the wine there to disengage the alcohol. The vapours from the second pass into the third, and vaporize the alcohol there contained. In this manner a middling fire occasions an immense mass of wine to boil, and the condensation of the vapours takes place in the worm. By this means a spirit of any strength may be obtained by taking the produce of the first vessel, of the second, or the third, and so on. If in place of putting wine in the first boiler water be substituted and wine placed in the others, a milder spirit is obtained than if the wine be used. Of course the liquid in the first vessel must be renewed as it is evaporated; but it is obvious, that whether water or wine be employed, this renewal may be effected, by various mechanical means, in such a way as not to require the operation to be stopped for this purpose till the whole of the alcohol is obtained from the wine used. This method has the great advantage of diminishing the quantity of combustible necessary, and of extracting more spirit from the same quantity of wine.

"These various ameliorations have produced a brandy much more mild than was obtained by the ancient methods.* In these the empyreuma was always perceptible, owing to the burning; but it has been found, that the consumers, particularly those of the north, accustomed to these burnt spirits, rejected the mild brandies; and the manufucturer has been obliged to mix them with burnt spirits, which tasted of empyreuma, to meet the taste of his customers."

(*To be continued.*)

CASE OF POISONING.* CHARACTERISTICS OF CORROSIVE SUBLIMATE.

We expected to have had a series of experiments on this substance to lay before our readers; but the friend who was to have undertaken the investigation has been suddenly called to the country: we therefore substitute the account (abridged) which is given of this poison and its effects, by the celebrated Orfila. Corrosive sublimate is the common name for the *deutochloride* of mercury, and is a compound of chlorine and mercury, in the proportion of 73.53 mercury, and 26.47 chlorine. It is obtained by heating mercury in chlorine. Calomel is *protochloride* of mercury, or mercury combined with a less quantity of chlorine; or the proportions are, mercury 84.746, chlorine 15,254.† The corrosive sublimate found in commerce, is either regularly crystallized or in white compact masses, demi-transparent towards the edges; the exterior is polished and shin-

* An apparatus on this principle has been tried in Britain; but the excise regulations have been found to occasion insuperable difficulties. While they exist it is impossible to introduce these new methods into our country; so that we have to thank them for being compelled to drink bad spirit at a dear rate. It is well observed by Chaptal, that "industry can only develope all its resources by having the power to try and to make use of every possible method." Nature, be it observed, bestows this power; but man, blind, beetle-eyed man, takes it from his fellows. And as long as the manufacture of spirits is restrained and regulated by a system, conceived in ignorance and executed with severity,—as long as the manufacturer must guide himself, not by chemical knowledge and the reason of the thing, but by these regulations, so long will the manufacture of ardent spirits be behind the other manufactures of the country.

* Vide Chemist, No. XXV.

† Ure's Dictionary.

ing, the interior is rough, covered with small brilliant crystals, so compressed that their sides cannot be distinguished. It tastes very acrid, caustic, styptic, and metallic, occasioning a contraction of the throat, which continues for a considerable time. Its specific gravity is about 5.1398; pulverized in an agate mortar and thrown on burning coals, it is instantly volatilized, spreading in a thick white smoke, with a strong pungent odour, (not at all resembling garlic, like arsenic) which affects the nose and throat, and frequently excites coughing. A piece of copper, quite clean, exposed to this smoke, appears tarnished, but on being lightly rubbed acquires the white and brilliant colour of mercury. Litmus paper is reddened by this smoke. Corrosive sublimate exposed to the air, loses a little of its transparency, and assumes the form of a powder at its surface. If it be formed with a little water into a paste with charcoal, and submitted to the action of fire, metallic mercury, carbonic acid, and muriatic acid are obtained. The theory of this change is as follows:—The charcoal, by the elevation of temperature and its great affinity for oxygen, takes a portion of that contained in the water and forms carbonic acid gas. The chlorine of the *protochloride* and the hydrogen, set at liberty by the decomposition of the water, unite to form muriatic acid, while the mercury and the excess of oxygenated gas escape in the form of gas. If a small quantity of corrosive sublimate, broken into small pieces, be dropped in a glass tube, at the bottom of which there is some caustic potash perfectly pure and melted, a portion of the sublimate escapes the action of the potash, and rising in the form of smoke, attaches itself to the sides of the tube, another portion mingles with the potash and acquires a red colour. If the heat is continued for five or six minutes, metallic mercury, adhering in globules to the side of the tube, is obtained, oxygen gas, mixed with undecomposed corrosive sublimate, escapes into the atmosphere, and a solid body, which is chloride of potassium, (muriate of potash) with the excess of potash employed, remains at the bottom of the tube. In this case the chlorine of the sublimate takes the potassium of the potash, while the oxygen of this alkali unites with the mercury and produces the red oxide, which imparts the colour to the mixture. But as this oxide is decomposed by heat, oxygen gas separates, and metallic mercury is produced, the presence of which may be ascertained by breaking the tube. It may happen, however, that the metallic globules are concealed by their union with a portion of the volatilized corrosive sublimate. In this case, the crust adhering to the sides of the tube must be scraped off and put into water, the sublimate is dissolved, and the globules of mercury precipitated. This experiment is equally conclusive if the potash and corrosive sublimate are mixed before being put into the tube; but in this case the mixture acquires a red colour by mere trituration. If a mixture of four parts corrosive sublimate and one part of antimony, perfectly pulverized, be gradually heated in a glass tube, chloride or butter of antimony is instantly formed, and is condensed in the upper part of the tube, a portion of the corrosive sublimate is volatilized, and at the bottom of the tube there remains metallic mercury and chloride of antimony, with, perhaps, a little antimony. Sometimes the mercury is distinctly visible, sometimes it is hidden by the other substances; in this case the residuum is put in water, when the mercury is deposited as metallic globules. If the tube be heated more than four or five minutes, the mercury flies off; care must, therefore, be taken not to do this. It is also necessary not to put more antimony than is mentioned, for the surplus unites with the live mercury, or envelopes and conceals it. The theory of this change is, that the antimony has more affinity for the chlorine than

the mercury has, and consequently takes it from the deutochloride; the mercury rests at the bottom. Caloric promotes this change, as it promotes all decomposition, where one of the elements is easily volatilized. Corrosive sublimate is dissolved in about eleven times its own weight of cold water; boiling water dissolves a greater quantity. Calomel is, on the contrary, insoluble in water; and thus, if it be mixed with corrosive sublimate, the solution is not complete. The solution of corrosive sublimate is styptic, metallic, disagreeable to the taste, transparent, colourless, and without smell; it reddens litmus paper, and makes the syrup of violets green. On being distilled in a retort, to which a lengthening tube and a receiver are adapted, this solution gives a liquid, which, on condensing, can be shown to contain corrosive sublimate volatilized and water. This fact is of importance. A saturated solution of carbonate of potash precipitates corrosive sublimate of a very dark brick colour; the precipitate being carbonate of mercury at the maximum of oxidation, hydrochlorate (muriate) of potash remains in the solution. On this carbonate of mercury being heated in a glass tube, the metal volatilizes, and attaches itself to the sides of the tube in globules. Caustic potash in alcohol, added in small quantities to a saturated solution of deuto-hydrochlorate (muriate) of mercury, precipitates it of a yellowish-red. If an excess of potash is added, the precipitate is oxide of mercury, at the maximum of oxidation, and of a beautiful yellow. In this case the potash takes the acid from the oxide; and if enough be not added, a small portion of the acid remains combined with it. In this case, on the oxide being dried, it becomes green at its surface, while it is yellow in its interior. If the solution of corrosive sublimate is extremely diluted, caustic potash gives a white, a brick, or a rose-coloured precipitate. This fact, too, is of importance. Subcarbonate of potash (salt of tartar) forms, with a solution of corrosive sublimate, a clear brick-coloured precipitate. Lime-water produces a precipitate of rather a dark yellow; on increasing the quantity of lime, the precipitate becomes red. Ammonia produces, with the solution of corrosive sublimate, a white precipitate, which is a double insoluble salt, composed of muriate of ammonia and oxide of mercury. On being heated, it becomes first yellow, then red, and forms ammoniacal gas, azote, calomel, and metallic mercury. A small quantity of hydrosulphate of ammonia produces a grey and white precipitate with the solution of corrosive sublimate; with a large quantity the precipitate becomes quite black. The precipitate is composed of sulphur and mercury, and varies in colour in proportion as these ingredients vary, and may be perfectly red. Sulphuretted hydrogen also produces a black precipitate with the solution of corrosive sublimate.

(*To be continued.*)

DICTIONARY OF CHEMISTRY.

Carica Papaya, *papaw-tree*. A remarkable plant, found in Peru and the Isle of France, which affords a matter resembling the flesh of animals, and hence called vegetable *fibrin*. A white juice is also obtained from it, which is said to be a remedy for the tape-worm.

Carinthine. A mineral, being a sub-species of *augite*.

Carmine. A red pigment prepared from cochineal. Four ounces of this latter, finely pulverized, are added to 4 or 6 quarts of distilled or rain water, previously boiled, and boiled together for six minutes. Eight scruples of Roman alum, in powder, are then added, and the whole is to be removed from the fire after one minute. When the decoction has cleared itself, decant it into large cylindrical glass vessels, covered over, and keep it undisturbed till a fine red powder is deposited. The liquor is then poured off, and the powder gradually dried. More colouring mat-

ter may be afterwards separated from the liquid by a solution of tin, and is very little inferior to the other.

Carnelian. A sub-species of calcedony.

Caromel. The smell exhaled by sugar when exposed to a strong heat.

Carrying Power. If heat be applied to the upper surface of liquids, it makes its way downwards by what is called the heat-conducting power of bodies, and which is found in solids as well as in fluids; but when it is applied to the lower part of fluids, these portions of them grow specifically lighter, and rise to the top, while other portions take the lowest place, to be heated in their turn. This is called the *carrying*, or *transporting* power of fluids, and was first accurately examined by Count Rumford.

Carthamus, *bastard saffron, safflower, Spanish red, China lake.* A pigment obtained from the flowers of a plant cultivated in Egypt, principally for the sake of its flowers. It is used for dyeing silk of a poppy, cherry, rose, or orange red. *Rouge* also is prepared from Carthamus. The red colour is extracted by a solution of subcarbonate of soda, and precipitated by lemon-juice. The precipitate is dried on earthen plates, mixed with *talc*, or French chalk reduced to powder. The fineness of the powder and the proportion of the precipitate constitute the difference between the finer and cheaper rouge.

Cartilage. About one third of the bones of animals is composed of an elastic semi-transparent solid substance, which has received the name of cartilage. It resembles coagulated albumen: it is that portion of the bones which is first formed, and in which the earthy matters that give firmness to these organs are deposited. A deficiency of these latter, or their absorption into the system, is the cause of the disease called rickets. As the phosphate of lime gives bones their strength, so cartilage gives them toughness and flexibility. Cartilage seems gradually to decrease and disappear as animals grow old.

Case Hardening. A process which gives to iron the hardness of steel, while it retains its own toughness. The instruments to be case-hardened are, before being quite finished, put into an iron box with powdered charcoal, and kept for a short time exposed to a strong heat, which converts the outer part into a coating of steel. The heated pieces are then immersed in water, and afterwards polished by the usual methods.

Caseic Acid. The name given by Proust to an acid he found in cheese, and to which he ascribes some of the properties of this substance.

Cassava, *jatropha manihat.* A curious American plant, containing a pleasant food and a deadly poison. The roots are squeezed, the starch or food remains, while the juice, which separates, is used to poison arrows. Even this juice gradually precipitates starch, which is perfectly wholesome. The root itself, till thus prepared or cooked, is poisonous; but when either boiled or prepared and dried, makes a very good bread, which is used for food.

COTTON MANUFACTURE.

	lbs.
The quantity of cotton converted into yarn in Great Britain and Ireland in one year is about	160,000,000
The loss in spinning may be estimated at $1\frac{1}{2}$ oz. per lb.	15,000,000
Quantity of yarn produced	145,000,000
Amount, supposing 18d. to be the average price per lb.	£10,875,000

According to Mr. Kennedy's calculation, that every person employed in spinning produces 900lbs. per annum, the number of persons employed is 161,111.

The number of spindles employed, supposing each to produce 15lbs. per annum, is 9,666,666.

The capital invested in buildings and machinery, cannot be less than 10,000,000l.

QUERIES.

To the Editor of the Chemist.

SIR,—Observing in No. XXV. of your interesting little Work, the communication of T. Z. on a method of decomposing water by means of galvanic electricity, I should take it as a favour if you or your Correspondent would answer the following Query. Does the decomposing power of the galvanic battery depend on the size of the plates or on the number of series? Your Correspondent gives a description of a simple apparatus for collecting the gases in a separate state; I take the liberty of inclosing another more complex, but very convenient, which, if it meets your approbation, you may, perhaps, insert in a future Number.

I remain,
Your obliged, &c.
J. R. S.

SIR,—Permit me to ask the best method of obtaining the gold from washings which are produced from old frames or other gilt work, in the business of carving and gilding (as it is usually called, to distinguish it from water-gilders.) The mode of proceeding with work which is to be regilt, is to wash the old gold off with a piece of cloth and water; it is then put in a pan, and when settled, the water is poured off, leaving the dischargings behind, which are dried and sold; but many pounds have been thrown away for want of knowing how to extract the gold from it. If, Sir, you will inform me the best method, by any chemical or other process, you will much oblige a constant reader of your paper.

Yours, most obediently,
In the dark,
Sept. 1st. OLIVER.

HEAVY AND LIGHT WATER.

TAKE two portions of the same water, and colour each of them differently, by means of any two of the substances mentioned at page 397 of the Chemist. Let one of these portions be heated while the other remains cold. If the hot water be then poured gently into a glass jar containing the cold water, it will remain on the surface and scarcely mix with the cold water; but if the cold water be poured on the hot it will sink to the bottom of the vessel; showing, that the specific gravity of the same body may be decreased or increased by the effect of heat.

TO CORRESPONDENTS.

The present Number completes the First Volume of The Chemist, and it was consequently our intention to publish a Supplemental Number next week, containing the Index, Preface, &c., but we are obliged to delay it for a few weeks, from being unable to get the engraving ready with which the Supplement is to be ornamented.

The communication of James Wright *has been received, and will be inserted in our next.*

Juvenis *is informed that we do not consider the Bible to be* authority *in matters of science. Every theory, either of light or of any other phenomena, must be substantiated by facts before it can be described as incontestibly proved. The passage which he quotes has given rise to a vast deal of discussion, and philologists are not yet decided as to its meaning. He will see, therefore, we should suppose, at once, the inutility of framing a theory of the whole universe on an obscure phrase in a book which is admired from our being unable to comprehend it. This will, we hope, be a satisfactory reason why we do not insert his letter. At the same time, we agree with him, that no questions which are not plainly above the power of man to solve should ever be regarded as excluded from our researches.*

*** *Communications (post paid) to be addressed to the Editor, at the Publishers'.*

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B. BENSLEY, BOLT-COURT, FLEET-STREET.